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The Problems of Contemporary Education

The History of Education

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The Problems of Contemporary Education

Selected Factors Influencing the Qualitative Level of Postural Health of Students in Slovakia

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Abstract

The current modern lifestyle of the 21st century has acquired a hypokinetic and sedentary character among the school population, which was further strongly supported by the global Covid-19 pandemic. This further supported the space for the upward trend of diseases, which also include disorders in the musculoskeletal system, postural health. The aim of our study was to find out and point out the factors, which determine the quality of postural health in adolescent students, and their mutual relationships. The sample consisted of 518 students in Slovakia, 266 girls aged$_{(x)}$ 16.5 ± 2.1 years (body height$_{(x)}$ 169.6 ± 6.8 cm, body weight$_{(x)}$ 60.2 ± 7.2 kg) and 252 boys aged$_{(x)}$ 16.9 ± 1.9 years (body height$_{(x)}$ 177.3 ± 8.5 cm, body weight$_{(x)}$ 66.4 ± 7.1 kg). In terms of data acquisition methods in the observed, standardized methods of physical education and pedagogical practice were used. The findings show that in the overall physical regime of students there are significant differences between the genders to the detriment of girls ($p < 0.05$) in terms of volume of physical activities, frequency and intensity ($p < 0.05$). The sedentary lifestyle in both genders showed a lack of physical activity in association with poor posture ($r = 0.789$) (sagittal and frontal plane). Also, higher food intake than energy expenditure results in higher body weight in the sample, which was reflected in the lower limbs (LL to X, $r = 0.717$ and foot pain $r = 0.739$ and fallen arch $r = 0.726$). In the observed sample, incorrect wearing of school bags was also found, significantly ($p < 0.05$) to the detriment of girls, as well as wearing incorrect shoes for both genders. These findings suggest that there are risk factors in students' lifestyles that contribute to the quality of their postural health, which need to be given much more attention in terms of primary prevention in both school and out-of-school environments. This project was supported by VEGA 1/0427/22 “Prevention of students' postural health by physical activity".

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1. Introduction

Health behaviours and attitudes encompass various factors that affect individual components of our health throughout our life. Regular physical activity plays a vital role in this process. "Every year, physical inactivity (passivity) costs Europe more than 500,000 deaths and over 80 billion euros" (EPRS, 2020). "According to conservative estimates, its economic impact will amount to 125 billion euros in 2030". The importance of physical activity for prevention of health problems is growing and schools play an irreplaceable role in it (EPRS, 2020), especially physical education, which is part of school curricula in the EU countries and a compulsory subject in primary and secondary schools. The average time allocation in the EU is 70 physical education lessons per year, which is only one third of time dedicated to languages and fifty percent of time allocated to mathematics (A Tesi..., 2020; Csillag, Kubišová, 2020). In Slovakia, primary and secondary school students have a total of 13,000 classes. However, they spend only about 7 % of this time doing physical activities. The remaining amount of time is allotted to theoretical knowledge (Bendíková, 2018).

Contemporary lifestyle in schoolchildren and students abroad, as well as in Slovakia, has become hypokinetic (Marques et al, 2015; Arundel et al., 2016; Panahi, Tremblay, 2018; WHO, 2020). Slovak students at primary and secondary schools are becoming less interested in mandatory and optional physical activities, no matter if they are organised or not. Research shows that 70 % of schoolchildren in Slovakia spend more than four hours playing computer games, searching the Internet, watching TV and playing on their mobile phones. Only every third student performs organised physical activities. As far as physical and sports education in Slovakia is concerned, there is one growing phenomenon – children that do not do physical activity at school. The number of students exempted from physical education or any physical activity due to various diseases and disorders is increasing as well. There are between 4 to 6 % of pupils with health problems at elementary schools and 13 % of students at secondary schools. These high rates really deserve more attention on the part of parents, students, schools and state institutions (Bendíková, 2018).

In 2007, the European Parliament adopted the Resolution on the Role of Sport in Education emphasising the bad situation related to physical education in schools of the EU member states and proposing a minimum of 3 PE lessons per week (EPRS, 2020; ICSSPE, 2010). The countries responded as follows: Hungary 5 lessons per week, Poland 4 lessons a week, Ukraine and Slovenia 3 lessons per week, France 5 lessons per week, Germany 4 lessons a week, Austria 150 minutes, Finland 135 minutes, Bulgaria 120 minutes, Belgium 100 minutes, Greece 240 minutes, Luxembourg 150 minutes and Spain 180 minutes. Not only did these countries increase the number of PE lessons per week, but they also diversified their curricula with the aim of improving their PE teaching processes. Physical education abroad focuses on improving students' health and (health-oriented) fitness and developing positive attitudes towards lifetime physical activity, which serves as primary prevention of "chronic non-infectious diseases". In Slovakia, these goals have not been fully achieved yet.

Sedentary and hypokinetic lifestyle among students abroad and also in Slovakia has led to a growing number of chronic non-communicable diseases, which used to be prevalent among middle-aged and old generation, but are now becoming more common among school population. Comparison of morbidity rates between the years 1996 and 2008 shows that the number of diseases and disorders per 10.000 children aged between 0 and 14 years has more than doubled. The increase in these rates has been even higher among adolescents aged from 15 to 19 years, when it comes to cardiovascular, metabolic and musculoskeletal diseases and disorders. There is an increase in the prevalence of respiratory diseases as well. Asthma and allergy diagnosis rates has more than tripled since 2000. In addition, mental disorders such as anxiety and depression are becoming more common. The prevalence of the flu and flu-like illnesses among children has grown by 34 % (Bendíková, 2018).

Lack of physical activity and unhealthy diet lead to an increasing number of obese people worldwide (WHO, 2017). Slovakia is also facing the obesity epidemic in school population (Bendíková et al., 2020). Research results show that approximately 18 % of children are overweight and about 7 % are obese, and the situation is getting worse. What is more, there is an increase in the prevalence of type 2 diabetes, which reduces life expectancy by 9 to 15 years. It is estimated that physical inactivity causes 10 to 16 % of diabetes mellitus cases. The number of diabetics has grown by 27 % since 2007. According to diabetologists, every third child born in the new millennium will

be diagnosed with diabetes mellitus, while now it is every 17th child. Watching TV for two hours every day also increases the risk of developing obesity and diabetes.

Nowadays, we encounter many factors that trigger functional and structural disorders in the musculoskeletal system. They are usually associated with the development of civilization and modern lifestyle. Proper posture is of great importance for the proper growth and development of children. Posture is influenced by uncontrollable endogenous factors and uncontrollable exogenous factors (which include physical activity, environment, habits, family environment, playing video games on TV, computer ...) (Straker et al., 2016; Straker et al., 2018).

The Slovak educational system is lagging far behind other countries when it comes to organisation of physical activity for school-aged children, which leads to deterioration in their health, fitness and general physical performance. This trend has been confirmed by several research findings. In the 2019–2020 school year, the Slovak Olympic Committee conducted pilot testing of pupils aged between 11 and 12 years in 39 Slovak schools. The total number of participants was 1.707 (878 boys and 829 girls). The research was based on the comparison of the Olympic Fitness Badge measurement results and the results of the Eurofit testing, which was conducted in 1993. The comparison included only those disciplines, which were monitored in both testing (standing long jump, timed sit-ups (30 seconds), endurance shuttle run, medicine ball overhead backward throw, static pull-up hold and shuttle run 10 x 5 m). The comparison showed the decrease in athletic performance in all five disciplines, both among boys and girls. The most significant decline was found in endurance shuttle run (30 %) and static pull-up hold (51 %) (SOSC, 2021). The decline in physical fitness was also caused by the Covid-19 pandemic, which resulted in weight gain among school population (Boyland, Halford, 2013; Scurt et al., 2022).

It is estimated that physical performance, fitness and health of today's school children after they turn 35 will be comparable to health status of today's 50-year old people. Diabetologists claim that over the past 40 years energy intake in children has increased by 23 %, while the amount of physical activity they perform has declined four-fold. They also draw attention to the fact that while our brain gets larger as we grow up, our skeletal muscle mass declines as we age.

Physical activity has a profound impact on the quality of life, lifestyle and health. Nevertheless, a sedentary lifestyle has become a serious issue that concerns schoolchildren as well (Sigmund et al., 2009; Panahi,Tremblay, 2018; Reisberg, 2020). That is why we can see increasing global efforts to increase the amount of healthy physical activity among population with the aim of preventing "chronic non-communicable diseases". All EU countries are encouraged to come up with their own recommendations on how much physical activity their citizens should do, taking WHO guidelines into consideration. The number of EU member states that produced such recommendations has risen significantly, beginning with 16 countries in 2011 rising up to 23 in 2018. In addition, there are more and more EU countries (including Slovakia) that have set out their own guidelines concerning physical activity in children and senior citizens.

Regular physical activity is one of the main determinants of health in school population, as well as the prevention of injuries (Nemček, Ladecká, 2020; Lenková, 2021). International comparative studies show that, besides compulsory physical education, schools need to implement other forms of exercise, such as physical activities before and after classes, during the breaks and also while teaching other subjects. Active breaks between classes should be implemented within school curricula (Hardman, 2008; Müller et al., 2008; Bendíková, 2018).

WHO (2018) as well as majority of experts recommend regular physical activity, healthy diet and changes in a daily routine as the best forms of disease prevention. These recommendations have already been implemented in international documents related to political decisions that have been taken with regard to health promotion. According to these documents, children and adolescents at schools should perform 60 and more minutes of moderate-intensity physical activity that should include age-appropriate, pleasant and diverse exercises.

Based on all the above-mentioned findings, the aim of our study was to find out and point out the factors, which determine the quality of postural health in adolescent students, and their mutual relationships.

2. Methodology

Research participants. The sample group n = 518 was composed of adolescent students from Slovakia. It comprised of 266 girls, whose average age$_{(x)}$ was 16.5±2.1 years, average body height$_{(x)}$ 169.6±6.8 cm and average body weight$_{(x)}$ 60.2±7.2 kg. The group also consisted of 252 boys, whose

average age$_{(x)}$ was 16.9 ±1.9 years, average body height$_{(x)}$ 177.3±8.5 cm and body weight$_{(x)}$ 66.4±7.1 kg). Table 1 shows the primary characteristics of the sample group.

Table 1. Primary characteristics of the sample group (n = 518)

(n = 518)	Girls (n = 266)		Boys (n = 252)	
	Body height/cm	Body weight/kg	Body height/cm	Body weight/kg
Factors	169.6 ± 6.8	60.2 ± 7.2	177.3 ± 8.5	66.4 ± 7.1
Age/years	16.5 ± 2.1		16.9 ± 1.9	
BMI	23.2 ± 1.5		23.3 ± 1.4	

Notes: BMI – Body mass index

Data collection and organization. The research was conducted in several consecutive stages in the year 2022 (3^{th}-5^{th} month). As far as data acquisition is concerned, we applied standardised procedures. We used CINDI standardised questionnaire to obtain information about students' daily routine. The questions were selected in accordance with the above-mentioned partial task. Basic somatometric measurements focused on body weight were performed by a highly precise and non-invasive method – by means of Tanita RD-953 body monitor that uses dual frequency bio-electric impedance analysis – BIA. We used a standardised method to carry out assessments of the musculoskeletal system, overall body posture, foot posture and pain, the results of which are used by physical education and medical experts. Subsequently, we evaluated the static component of overall standing, the body posture, using the method developed by Klein and Thomas and modified by Mayer (Bendíková, 2017). This method evaluates body posture by totalling up points each monitored area gets. The points given range from 1 to 4 according to the current level of body posture. This assessment was followed by classification into the qualitative body posture levels. The evaluation was focused on: I. Head and neck posture, II. Chest (shape), III. Abdomen and pelvic inclination, IV. Spine curvature, V. Frontal body posture (Evaluation of shoulders – Shoulder blades/scapulas). Evaluation of body postures: I. Correct body posture – 5 points, II. Good body posture – 6–10 points, III. Bad body posture – 11–15 points, IV. Incorrect body posture – 16–20 points. After that, we assessed foot posture using the non-invasive diagnostic podoscope. We evaluated foot posture from the rear as we focused on the ankle joint: a) (1 point) – slim ankles touching each other, good upright posture, b) (2 points) – ankles are slightly turned inwards, c) (3 points) – ankles roll excessively inwards, overpronated feet collapse inwards, bad posture. Pain intensity was measured by means of the visual analogue scale (VAS) – an 11-point Likert scale: 0 = no pain, 10 = pain as bad as it could possibly be (Vojtaššák, 2000).

It is a cross-sectional study in the framework of longitudinal research, through which we point out that insufficient primary prevention of postural health in adolescence causes health problems of the musculoskeletal system.

Data analysis. We processed acquired data using the IBM SPSS Statistics 17 programme and MS Excel 2017. Data processing was focused on the size (n), percent frequency distribution (%), standard deviation (s), extent of variation ($V_{Rmax-min}$) and arithmetic mean (x). We used an unpaired T-test (T_{test}) and a chi-squared test (χ^2) in order to compare qualitative and quantitative data about the boys and the girls. We also used the effect size (r) analysis, logical analysis and synthesis, induction and deduction as well as comparison and generalisation. The acquired data were then compared with other sources of literature and presented in tables and images.

3. Results

The findings show that there are significant differences between males and females as far as their physical activity routine is concerned. We found that the girls had worse results ($p < 0.05$) in terms of the amount of physical activity they perform (volume - V_{PA}), its frequency ($p < 0.05$) as well as its intensity ($p < 0.05$) (Table 2).

The female students (n = 266) performed 1 hour and 45 minutes of sports physical activity (V_{PA}) per week, hereinafter referred to as PA, including 1 hour and 10 minutes of free-time activities and 35 minutes of exercise done during physical and sports education classes. The male students (n = 252) had somewhat better results as they spent 1 hour and 55 minutes doing spare-time sports activities and 1 hour of physical activity during PE classes. The overall weekly amount

of physical activity (V_{PA}) was not significantly different for male students (Ttest = 0.279, $p > 0.05$) and for female students."

When it comes to frequency (F_{PA}), more than a half of female students (57 %, n = 152) performed physical activity irregularly compared to male students (34 %, n = 86), with a difference ($\chi^2 = 27.311$, $p < 0.05$, df = 3). Only 23 % of the girls (n = 61) and 33 % (n = 83) of the boys perform physical activity only once a week. 15 % of the girls (n = 40) and 26 % of the boys (n = 66) perform physical activity twice per week, while only 5 % of female students (n = 13) and 7 % of male students (n = 7) do sports activities three times a week.

Intensity of physical activity (I_{PA}) is very important when it comes to health. We found out (Table 2) that 67 % (n = 178) of the girls and 42 % of the boys (n = 106) perform low-intensity sports activities, while only 19 % of female students (n = 50) and as many as 45 % (n = 113) of male students do medium-intensity physical activity ($\chi^2 = 28.133$, $p < 0.05$, df = 3). The remaining 13 % of the boys and 14 % of the girls do submaximal or high-intensity exercise.

Table 2. Physical activity among students (n = 518)

Volume of PA/per week	Physical activity and sports			
gender (n = 518)	Leisure time (hour/min)		Physical & sports education	
Girls (n = 266)	1: 10		0 : 35	**Σ** 1: 45
Boys (n = 252)	1 : 55		1 : 00	**Σ** 2 : 55
Difference (d%)	0 : 45		0 : 25	**Σ** 1 : 10
Independent samples T_{test}	$T_{test} = 0.279$ ($p < 0.05$)			
Frequency of PA/per week	Irregularly	1x/week	2x/week	3x/and more
Factors n/(%)	n/(%)	n/(%)	n/(%)	n/(%)
Girls (n = 266)	152 (57 %)*	61 (23%)	40 (15 %)	13 (5 %)
Boys (n = 252)	86 (34 %)	83 (33 %)	66 (26 %)	17 (7 %)
Difference (d%)	66 (23 %)	22 (10 %)	26 (11 %)	4 (2 %)
Chi-square test (χ^2)	$\chi^2 = 27.311$ ($p < 0.05$, df = 3)			
Intensity of PA/per week	Low	Medium	Submaximal	High
Girls (n = 266)	178 (67 %)	50 (19 %)	27 (10 %)	11 (4 %)
Boys (n = 252)	106 (42 %)	113 (45 %)*	20 (8 %)	13 (5 %)
Difference (d%)	72 (25 %)	63 (26 %)	7 (2 %)	2 (1 %)
Chi-square test (χ^2)	$\chi^2 = 28.133$ ($p < 0.05$, df = 3)			

Notes: (n) – size, (%) - percentage, (*) - significance ($p < 0.05$)

Our findings point to a dominant upward trend in sedentary activities (Table 3) compared to active physical activities in the daily routine of schoolchildren. The analysis of the sedentary activity in the monitored group of schoolchildren (n = 518) shows that on average 1/3 of the day has a sedentary character, to which it is necessary to mention another on average 4.5 hours/day online classes and on average 1.2 hours preparation for classes. On average, schoolchildren spent most time (3 hours/day) watching television (82 %, n = 427), 76 % (n = 394) of schoolchildren reported time spent at PCs with the internet, mobile phones, or listening to music, and 56 % (n = 290) reported playing on computers and mobile phones.

Table 3. Average time schoolchildren spend doing sedentary activity (n = 518)

Average time spent in sedentary activity	(x)	(n)/%
Time spent watching TV	3 hours	427 (82 %)
Time spent gaming on computer and mobile	2.1 hours	290 (56 %)
Time spent learning	1.2 hours	202 (39 %)
Time spent on PC, internet, (outside of class) ...	2.2 hours	394 (76 %)
Total hours/x(%)	8.5 hours	326/(63 %)

Notes: (x) - arithmetic mean, (n) – size, (%) - percentage

Table 4 presents the most common postural disorders in our sample group (n = 518). Kyphotic body posture was found in 30 % of the boys (n = 76) and 18 % (n = 48) of the girls. 12 % (n = 32) of female students and 9 % (n = 23) of male students had hyperlordotic posture. Scoliotic body posture prevailed in 41 % of the girls in contrast with 20 % of the boys (n = 50), with a difference ($\chi^2 = 18.987$, $p < 0.05$). There were 6 % (n = 16) of the girls and 4 % (n = 10) of the boys who had hypolordotic body posture.

Table 4. Functional postural disorders in students (n = 518)

Body posture/ factors	Kyphotic body posture	Hyperlordotic body posture	Hypolordotic body posture	Scoliotic body posture
gender (n = 518)	n/(%)	n/(%)	n/(%)	n/(%)
Girls (n = 266)	48 (18 %)	32 (12 %)	16 (6 %)	109 (41 %)*
Boys (n = 252)	76 (30 %)	23 (9 %)	10 (4 %)	50 (20 %)
Difference (d%)	28 (12 %)	9 (3 %)	6 (2 %)	59 (20 %)
Chi-square test (χ^2)	$\chi^2 = 18.987$ ($p < 0.05$, df = 3)			

Note: (n) – size, (%) - percentage, (*) – significance ($p < 0.05$)

Body posture indicates whether the muscular system functions properly or not. Table 5 presents our findings in this area. We found out that only 8 % (n = 21) of female students had correct body posture, 15 % of them (n = 40) had good body posture, 66 % (n = 176) had bad body posture and 11 % (n = 29) of the girls had incorrect body posture.

Table 5. Overall posture evaluation in schoolchildren (n = 518)

Body posture/ points (p)	Correct body posture (0-5 p)	Good body posture (6-10 p)	Bad body posture (11-15 p)	Incorrect body posture (16-20 p)
gender (n = 518)	n/(%)	n/(%)	n/(%)	n/(%)
Girls (n = 266)	21 (8 %)	40 (15 %)	176 (66 %)*	29 (11 %)
Boys (n = 252)	30 (12 %)	66 (26 %)	123 (49 %)	33 (13 %)
Difference (d%)	9 (4 %)	26 (11 %)	53 (17 %)	4 (2 %)
Chi-square test (χ^2)	$\chi^2 = 17.790$ ($p < 0.05$, df = 3)			

Note: (n) – size, (%) - percentage, (*) – significance ($p < 0.05$)

As far as male students are concerned, 49 % (n = 123) had bad posture, 26 % (n = 66) of them had good posture, 12 % (n = 30) had correct body posture and 13 % (n = 33) of the boys had incorrect body posture.

The aforementioned findings show that female students had worse body posture in comparison with male students. Following the quality assessment of body posture, we found a difference between female and male students ($\chi^2 = 17.790$, $p < 0.05$, df = 3) at the third level of quality (bad body posture), with the girls having worse posture than the boys. The average assessment was (x) 12 ± 2.79 and the extent of variation ($V_{Rmax-min}$) equalled to 10.

Sedentary lifestyle and a lack of physical activity in both genders are associated with overall improper body posture ($r = 0.789$) in sagittal and frontal planes. There was a difference ($\chi^2 = 27.109$, $p < 0.01$) between the girls and the boys when it comes to pain in the lumbar and cervical spine: 63 % of the girls (n = 168) and 29 % of the boys (n = 73).

In terms of evaluation of body posture of the individual segments, we found the following: female respondents faced problems with abdomen and pelvic inclination in the highest percentage, which consisted of more than half of them, followed by spine curvature and frontal body posture. Among male respondents, the highest percentage was found in the head and neck posture followed by abdomen and pelvic inclination and frontal body. For both genders the lowest percentage was with chest issues.

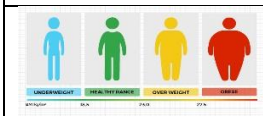
Table 6. Evaluation of individual body posture regions in schoolchildren (n = 518)

Points/ evaluation	I. G B	II. G B	III. G B	IV. G B	V. G B	VI. G B
1	18 % 15 %	48 % 50 %	11 % 20 %	14 % 19 %	16 % 17 %	22 % 30 %
2	22 % 18 %	39 % 31 %	17 % 24 %	28 % 27 %	38 % 25 %	23 % 38 %
3	46 % 53 %	10 % 14 %	56 % 49 %	52 % 43 %	47 % 46 %	49 % 22 %
4	14 % 14 %	3 % 5 %	16 % 7 %	6 % 11 %	6 % 12 %	6 % 10 %
Chi-square test (χ^2)	$\chi^2 = 16.667$ ($p < 0.05$, df = 5)					

Notes: I. posture of head and neck evaluation, II. shape of thorax evaluation, III. shape of the abdomen and the inclination of the pelvis evaluation, IV. total curvature of the spine evaluation, V. height of the shoulders and the position of the shoulder blades evaluation, VI. lower limbs evaluation, 1-4 points, G – Girls, B – Boys

The Table 7 shows the evaluation of BMI and fat percentage in students (n = 518) among girls and boys. There are 4 levels of BMI and fat percentage. 42 % (n = 112) of the girls and 56 % (n = 141) of the boys were in the second level, that is considered as normal or optimal one.

Table 7. The evaluation of BMI and fat percentage in schoolchildren (n = 518)

Factors/genders	**Assessment of BMI and fat in students (n=518)**							
Levels of BMI	**I. underweight**		**II. normal**		**III. overweight**		**IV. obese**	
Gender/girls/boys	**G (n=266)**	**B (n=252)**	**G (n=266)**	**B (n=252)**	**G (n=266)**	**B (n=252)**	**G (n=266)**	**B (n=252)**
BMI (n %)	9 %	6 %	**42 %**	**56 %**	39 %	31 %	10 %	7 %
								
Gender/girls/boys	**I. low**		**II. normal**		**III. increased**		**IV. high**	
% Fat	9 %	6 %	**39 %**	**51 %**	37 %	34 %	15 %	9 %
Good/Bad for health	✗	✗	✓	✓	✗	✗	✗	✗

Also 39 % (n = 104) of the girls and 51 % (n = 129) of the boys, according to the amount of fat percentage, were in this normal level. Each value that is shifted to the right or left is not the best one. It has a negative impact on health and postural health of students.

As far as our sample group (n = 518) is concerned, we found that the body weight in both genders had an impact on lower limbs. This means that overweight and obese students had valgus X-shaped feet, r = 0.717, foot pain r = 0.739 and a fallen foot arch = 0.726.

The examination of feet in our sample group (n = 518), which was carried out by means of a podoscope, showed that 45 % (n = 233) of the subjects fall under the first and second category (1 and 2 points), while 49 % (n = 254) belong to the 3rd category and the remaining 6 % (n = 31) of students were assigned to the 4th category. During the examination of ankle posture, 44 % (n = 228) of students were given 1point. Their ankles were slim and they touched each other; they had good upright posture. Only 9 % (n = 47) of the students were assigned to the 3rd category (3 points). Their ankles rolled excessively inwards, their overpronated feet collapsed inwards, which means that their posture was bad. We also found out that 47 % (n = 243) of the students fell under the 2nd category (2 points) because their ankles were slightly turned inwards. According to these findings, we can draw a conclusion (while respecting other factors) that increased body weight and obesity are associated with foot posture.

As far as proper carriage of school bags is concerned, there was a difference ($\chi^2 = 15.731$, $p < 0.05$) with worse results for the girls (58 %, n = 154). Both female and male students wear improper footwear.

4. Discussion

Lack of physical activity and low intensity of exercise in these difficult times can significantly contribute to prevalence of functional and structural health problems, including disorders of the musculoskeletal system.

Overall body posture of the students in our sample group was influenced by an improper postural stereotype caused by insufficient motor control, low neuromuscular coordination as well as other external and internal factors. It is important to emphasise that the deep stabilisation system (the core consisting of abdominal, spinal and pelvic regions), which connects the upper and lower body parts, plays a vital role in motor control. The balance between the aforementioned regions is a prerequisite for a proper body posture. Incorrect movement stereotypes make individual muscle groups in a muscle gain generalised, which results in improper posture of shoulders, hip stability and extension, limited range of motion and pain at the back of the thigh, ankles and feet.

Kratenová et al. (2007) reported in their study that on average children spent 4 hours per week playing sports and 14 hours per week watching TV/VCR and playing computer games. 20 % of children had a significantly higher probability of poor posture than children who played sports. Incorrect posture was diagnosed in 38.3 % of children, more often in boys. While in our group, we found incorrect posture to be more common in girls. Children with poor posture more often reported headaches and cervical and lumbar spine pain, as in our sample.

Yang et al. 2020 of their studies found incorrect postures in children and adolescents in 65.3 %. Where girls had a higher prevalence of poor posture than boys. With increasing age, the prevalence of incorrect posture was higher, which confirmed the similarity of our findings.

Musculoskeletal disorders often begin to develop in childhood due to improper body posture and insufficient amount of physical activity in children's daily routine (Rodríguez-Oviedo et al., 2018). Other factors that have an impact on body posture include the weight of school bags and their carriage (Bueno, Rech, 2013) as well as wearing appropriate footwear (Ningthoujam, 2014).

In addition, body posture in children is considerably influenced by their body weight. Nowadays, rates of childhood overweight and obesity are increasing worldwide. This is a public health problem that affects people's health in their adulthood. Visceral obesity represents a risk factor for type 2 diabetes mellitus, atherosclerosis and cardiovascular diseases (Neeland et al., 2019). What is more, excessive weight and obesity greatly contribute to improper posture of lower limbs and feet (Maciałczyk-Paprocka et al., 2017), where one region disrupts proper functioning of the knee, the hip joint and the lumbar spine (Kussuki et al., 2007). That is why appropriate and timely intervention is very important (Černický et al., 2018, Bendíková, 2020, Bendíková, Balkó, 2022). Considering all the above, it is necessary to devote attention to health-oriented fitness in children (body composition, body weight, body posture, physical performance, etc.) (Cristi-Montero et al., 2014; Mayooran et al., 2014).

5. Conclusion

Our findings confirm that amount, frequency and intensity of physical activity in schoolchildren are on the decline. Even though boys do less sports and exercise, the amount of physical activity in girls is even smaller. We found out that today's schoolchildren lead a sedentary lifestyle. Pain occurs when they are physically inactive. The girls in the sample group had worse body posture than the boys. A lack of physical activity is associated with bad body posture, while excessive weight can lead to foot pain and the fallen arch.

It is important to bear in mind that a lifestyle and a positive health attitude develop throughout our lives and that they depend on many factors such as upbringing, social and economic environment, traditions, stereotypes, laziness, education, experience, etc. Adoption of a healthy lifestyle also requires consistency, perseverance and determination. That is why now physical education plays such a vital role.

Physical and sports education directly or indirectly creates the space for diversification and innovation of the curricula and classes that should have a positive effect on health determinants as well as physical, functional and motor development and health-focused physical fitness of school-aged children and adolescents.

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7. Conflict of interest

The authors declare no conflict of interest.

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Screening Financial Literacy in Young Business-Oriented Professionals. Conjectures of Financial Duality and Financial Divergence

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Abstract

The main purpose of this research is the estimation and analysis of the level of Financial Literacy of professionals oriented to business management. The sample was composed of young executives starting MBA studies. The level of FL was analyzed in detail through various statistical techniques, under two perspectives. The first perspective referred to the dimensions involved in the definition of FL and the second referred to the demographic characteristics of the population. Theresults show a level of FL that does not reach an acceptable minimum in its global measurement; neither in its different dimensions, but the Information dimension. In general terms, this result is reproduced at the different demographic segments analyzed. In terms of the demographic categories, there were no differences in age or gender. Based on the income level, there were differences in the Knowledge and Information dimensions. Likewise, based on the number of dependents and on profession, there were differences in the Consciousness dimension. The results allow us to make two important conjectures for further research: the Financial Duality and the Financial Divergence conjectures. It is postulated that the Financial Duality conjecture could be explained through Kahneman's theory of System 1/System 2 and corresponding behavioral biases.

Keywords: financial literacy, financial knowledge, financial capacity, financial information, financial consciousness, financial duality conjecture, financial divergence conjecture.

1. Introduction

Life well-being is increasingly dependent on the goodness and quality of the plans and decisions made. Within this context the financial dimension takes particular importance for better allocation of income and expenses over time reflects on better balance of consumption levels throughout life, access to products and services not possible with current income, the well-being

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and education of offspring, reduction of risks exposure, etc. (Lusardi et. al, 2010; Lusardi, Tufano, 2015; Hamid, Loke, 2020). Nowadays, these potential benefits are available to increasingly large segments of the population and with greater ease of access (Klapper, Lusardi, 2020; Ergun, 2018).

To access these higher standards of living a basic understanding and comprehension of routinely financial affairs is necessarily; which implies capabilities on financial reasoning and skills to apply basic financial concepts. In summary, an adequate level of financial literacy (FL) is required. (Huston, 2010; Remund, 2010; OECD INFE, 2011). The financial management and behavior of individuals can amplify the spectrum of quality of life levels that they can access; it can greatly improve their well-being or lead their lives into major disasters. Finance amplifies the consequences of decisions and plans.

Thus, the importance of reaching adequate levels of FL. Growing demand for FL is related to the greater dissemination and innovation of financial products and services, as well as to their greater diversity and sophistication; products and services which are becoming more and more accessible to broader population segments (Fernández et. al., 2014). Individuals need to acquire an acceptable level of financial capabilities, including the understanding of financial concepts, capacities to use these financial concepts and instruments, knowledge of the implications of financial decisions, and the ability to keep informed of the alternatives offered by the market (van Rooij et al., 2012). In addition, individuals also need to acquire the ability to think about finance naturally, spontaneously, and on a regular basis. This challenge faces the obstacles of the lack of training (Hastings et al., 2013) and the natural limitations of financial thinking identified by various behavioral economics researchers, limitations that translate into different biases related to a rational behavior[1] (Kahneman, Tversky, 1979).

Due to this importance, the society as a whole, including governments and private institutions, as well as academic institutions have directed its attention towards this issue, especially after the financial crisis of 2007–2009. This financial crisis evidenced the low level of FL in individuals (Mandell, Klein, 2009; Robb, Woodyard, 2011; Shahrabani, 2012).

FL is much more than knowledge; it is a broad and complex concept. According to OECD (2014), it is the knowledge and understanding of financial concepts and risks; skills and capabilities; motivation and confidence to apply such knowledge and understanding; dimensions that help individuals to make effective decisions in different financial contexts to improve their well-being.

Importance of FL is such that individuals should naturally handle its different dimensions when facing situations where the efficient use of financial resources is at stake. Designs and implementation of FL educational programs play an important role to achieve this objective, aiming at improving financial literacy levels in the population (Lusardi et al., 2010; Lusardi, Mitchell; 2014). However, these programs have not achieved their purpose yet. Research conducted to date has shown that almost all sectors of most populations have not yet sufficiently comprehend the dimensions of FL (Lusardi, Mitchell, 2014).

L. Klapper and A. Lusardi (2020) emphasize that without an adequate progress in FL, people will not be able to make informed decisions regarding savings, investment, and loans. Likewise, they found that globally, one in three adults has knowledge of three out of four basic financial concepts: interest rates, compound interest, inflation and risk diversification. Moreover, they found that women, low-income and less educated adults are more likely to have important financial knowledge gaps.

Having financial knowledge is not enough; skills to apply it based on timely information and consciousness of the consequences of decisions is of high importance for the well-being of the individual and, as a consequence, of the society. FL is important in most aspects of human life; if resources are not properly manage, wealth can be wasted and financial goals will be difficult to achieve (Anik Yuesti et al., 2020). A key desired outcome for financial education is sustained financial well-being, in which people can fully meet current and ongoing financial obligations, can feel secure in their financial future, and are able to make choices that allow enjoyment of life (U.S. Financial..., 2020).

This paper presents the results of the analysis of the levels of FL achieved by professionals interested in business management, a population that has received little or no attention. The study of this population is of particular importance because they represent a community with a modern

[1] For example, confirmation bias, attentional bias, improbable favorite bias, anchoring bias, etc.

lifestyle, professional knowledge and interest in business management and in finance. The study of this population permits to inquire to what extent the backlog in FL reported in the literature is related to the lack of interest or deficiencies in training on FL or if it is linked to behavioral biases reported in the literature of economic theory and psychology (Kahneman, Tversky, 1979).

The results obtained reflect a level of LF that is below adequate, both at the global level and of its components. FL was analyzed from the perspective of the dimensions that define it but also according to the different demographic characteristics of the population studied.

The analysis carried out has allowed posing two conjectures, the Financial Duality conjecture and the Financial Divergence conjecture, for further research.

Raising these conjectures has been possible due to the characteristics of the population studied. The first conjecture has to do with a possible differentiation between the use of skills for professional financial management and for personal affairs. The second conjecture, linked to the first, has to do with possible divergences in the acquisition of skills and competencies in their financial training, for professional or personal use.

The paper is organized in seven sections. The following section, section two, present a definition of FL and its dimensions for this research--the particularity of the approach used to identify the dimensions refers to its basement on a model of financial behavior, unlike other research. Section third highlights the importance of studying the above-mentioned population, which can serve as a standard of comparison for other researches. This section also explains the sample, which has been of convenience, but also representative at the international level. Section fourth describes the instrument and the fieldwork. Section fifth explains the questions and hypotheses of research, which are organized into 3 groups: Global Approach, Demographic Approach and Dimensional-Demographic Approach. Section sixth presents a summary of the Sample Data as well as the analysis made according to each of the three mentioned approaches. The last section is the Conclusions section where the two important conjectures for further research are presented and discussed it.

2. Results and discussion

Definition of financial literacy and its dimensions

Financial Literacy is a concept that is not yet valued in its true dimension, nor is it given due importance; in spite of a modern life characterized by individuals constantly deciding among increasingly sophisticated and more accessible financial products. People face their retirement plans, make decisions regarding savings and investment alternatives, and choose among alternative credit conditions without a minimum of financial knowledge (Lusardi, Mitchell, 2014).

Compounding this situation, a low development of financial reasoning is observed, explained by lack of skills and financial maturity. This state of affairs blocks the monitoring and understanding of the financial environment in which they operate, making it practically impossible to evaluate the impact of their decisions and plans.

The first attempts to study FL date back to 1787, when John Adams[1], recognized for the first time the importance of FL and the need to develop a basic knowledge about money management. Nevertheless, it was not until the financial crisis of 2007–2009 that FL received its due importance. That event prompted a large volume of scattered investigations, though basic challenges are still pending. In spite of the huge number of research papers generated in recent years, progress on the subject is very limited. Inquiries on FL still have to do with basic aspects such as the study of the dimensions involved in FL, dependence on the concept of FL on the population in question and the definition of suitable and standardized measurement instruments.

FL has acquired many different meanings and has been used from different perspectives: knowledge of financial products (differences between stock and bond, between a fixed and adjustable rate mortgage, etc.); knowledge of financial concepts (inflation, capitalization, diversification, credit scores, etc.); having the mathematical skills necessary to make effective financial decisions and being involved in certain activities such as financial planning. Despite the efforts made to date, the evidence shows that there is not a consensual standardized concept of FL (Vitt et al., 2000).

Based on the above, some researchers emphasize on the definition of FL from a perspective of knowledge of necessary financial terms and concepts to increase skills, confidence and

[1] John Adams is considered the founding father of FL in the United States (Goyal, Kumar, 2021)

motivation in the management of a proper consumer decision-making (Bowen 2002; Fox et al., 2005; Courchane y Zorn, 2005; Willis, 2008; Remund 2010). Moreover, some authors consider that FL should combine knowledge and the ability to use that knowledge in the economic life but also maximize people's opportunities to improve their well-being (Johnson y Sherraden, 2007). Some researches state that FL is the knowledge of basic financial concepts and the ability to do simple calculations; and others state that FL is a measure of how well a person can understand and use information related to personal finance. However, in practice it is difficult to explore how people process economic information and make informed decisions about household finance. (Lusardi, Mitchell, 2011a, Huston, 2010; Lusardi, Mitchell, 2011b).

From the perspective of knowledge, skills and application action, FL is the ability to use knowledge and skills to manage financial resources effectively for financial security (Jump$tart Coalition..., 2007; Annual Report..., 2008; Hung et al., 2009).

FL has also been analyzed from a perspective of capacity and use of financial concepts supported by information and communications technology (Servon, Kaestner, 2008). Moreover, it has also been analyzed based on relevant skills and abilities to read, analyze, manage, and communicate personal financial conditions that affect material well-being; ability to discern financial alternatives, plans, and efficient respond to everyday life events that affect financial decisions, including events in the economy (Vitt et al, 2000).

Other researches have analyzed the relationship between FL and people's financial behavior. These studies recognize that this relationship is not clearly defined. There are researches that have found direct relationships, and others found that the relationship is indirect and that there is even evidence of a neutral relationship (Fox et al., 2005; Lusardi, 2004; Mandell, 2005; Willis, 2008; Lyons, 2006; Bell et al., 2009; Alsemgeest, 2015). While other studies considered the definition of FL from other different perspectives (Schuchardt et al., 2009 cited by Nicolini et al., 2013). These varieties of approaches to the concept of FT signals the lack of consensus for a definition of the concept, which affects the finding of a standard measurement instrument. This has led that some studies use specific instruments for each specific population (Nicolini et al., 2013).

As a consequence, this evolution of FL has produce different factors, such as knowledge, skills, attitudes, behaviors and personal circumstances, to measure it.

The analysis of Australia and New Zealand Banking Group Limited (ANZ, 2015) proposed a conceptual framework of FL with five independent components: (a) keeping track of finances, (b) planning ahead, (c) choosing financial products, (d) staying informed and (e) financial control. Each component “is measured by several behavioural indicators. The framework also points out that these five components of financial literacy are influenced by such things as people’s financial knowledge and numeracy and their financial attitudes as well as their socio-demographic and household characteristics” (Australia and New Zealand..., 2014).

In all cases, studies do not consider in depth the aspects that help people in their own analysis, such as the technology, the daily economic information and the consciousness of the results of their decisions.

This requires a definition of FL that adapts to the evolution of both the financial products offered by the market, and the innovation of financial technology, which are part of our lives. The new definition should help to develop a standard measurement instrument that validates the relationship between financial knowledge and the current financial behavior of people.

The OECD/INFE (2018) defines FL as: “A combination of awareness, knowledge, skill, attitude and behaviour necessary to make sound financial decisions and ultimately achieve individual financial wellbeing.” For a contemporary definition of FL, it should be considered that the Information dimension (which includes technology) should be included in the dimensions of FL.

Figure 1 explains FL from the perspective of the required components that influence the financial behavior of individuals. Based on this figure, the proposal is a broad and general definition of FL, which is given specificities through its dimensions involved. Financial Literacy is the capacity of individuals to manage their personal finance in order to achieve their well-being. This definition includes capabilities for decision-making, and short-term and long-term financial planning.

It includes the understanding of basic financial concepts of relevance to personal finances, as well as the ability to apply them; considers consciousness of the possible consequences of decisions and finally it involves monitoring the economic and financial situation. This definition proposal is based on the different definitions in the literature and it seeks to encompass the dimensions involved in our population of interest.

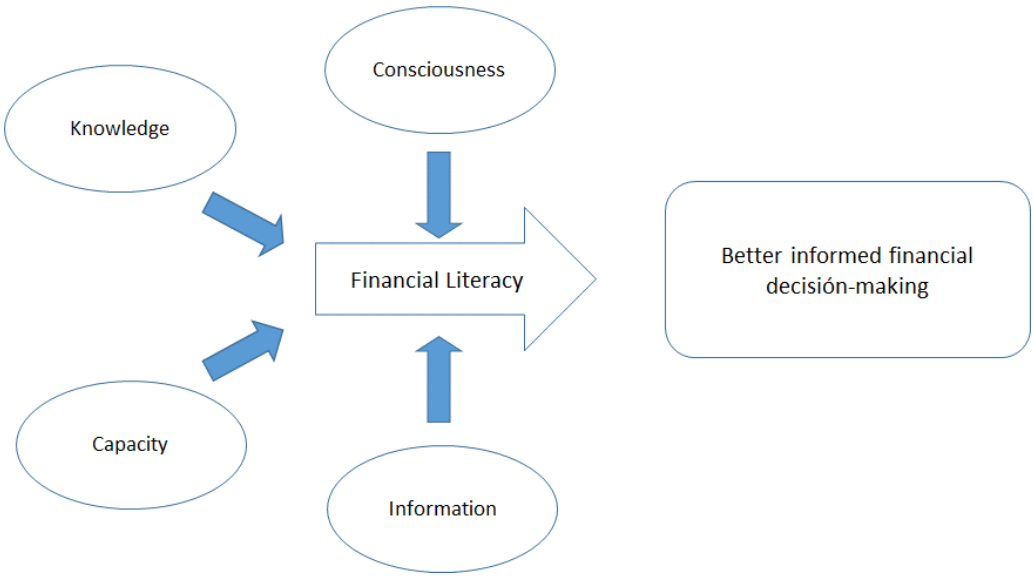

Fig. 1. Behavioral Dimensions of Financial Literacy

Specifically, the following dimensions are considered for FL. Knowledge, the understanding of the basic financial concepts for making personal decisions, as well as for the elaboration of personal plans. Capacity, ability to apply financial knowledge. Information, monitoring the situation and perspectives of the economic and financial environment. Consciousness, ability to weigh different possible outcomes in terms of personal benefit.

Population and sample

Population: Identification and Importance

The interest of this study is to analyze the FL level in professionals interested in business management, and to identify possible differences due to demographic characteristics (Chen, Volpe, 1998; Lusardi, Mitchell, 2011a; Atkinson, Messy, 2012; OECD, 2013). The findings of Potrich et al. (2015) confirm the need to design effective actions to minimize the FL problem with a model that considers socioeconomic and demographic variables that identify the FL level of the individuals.

This population composed of young professionals is of great interest because it allows us to analyze to what extend the accumulation of knowledge and academic preparation can improve the FL development. It also allows us to study a population with more access to financial products and services, with the maturity and the ability to make the most of those services, with modern characteristics and international lifestyles. Within this population, an important segment is made up of professionals with interest in pursuing further graduate studies in management. This population will allows us to analyze whether interest in professional management affairs have incidence on personal financial capabilities, and to what extent. This is important because FL does not mean the application of methodologies and professional practices; it concerns with the development of a natural financial reasoning and behavior of the individuals.

An adequate vehicle to analyze this population is the population defined by professionals entering an MBA program, they are interested in business management, their life characteristics are linked to modernization and internationalization, and they want to keep informed about financial and economic matters. Likewise, the cohort-age of these professionals were of special interest because they were developing a professional life and, most of them, trying to start a family. All these demographic characteristics were of particular interest for the study of FL. In addition, this population allowed us to analyze the differences between management professionals and non-management professionals.

Sample

This research used a convenience sampling without losing the representativeness of the population to be studied. The convenience sampling was necessary to control population characteristics linked to the interest in business management, young working professionals, and modern and international daily life habits.

People from the CENTRUM MBA program of the Pontificia Universidad Católica del Perú (PUCP) were selected because they fulfilled the above-mentioned characteristics. PUCP was founded in 1917 and it is the main university in Peru. Its business graduate school (with MBA programs) started in

2001 and, during its first 10 years, obtained the three most recognized accreditations of the world: AMBA, AACSB, and EQUIS, among others, up to now. It is one of the leading business schools in South America, and it is widely recognized worldwide. Its programs, faculty, students and partnerships with important universities around the world are recognized at an international level.

The sample was composed of individuals from the CENTRUM MBA program. The information was taken during the first semester 2021. In the sections of Description of the Field Work and Summary of the Sample Data there is more information about the characteristics of the sample and its sampling process.

Description of instrument and field work

Description of the Instrument

The bibliographic research was a systematic, detailed and explicit review that allowed us to amalgamate different researches on FL and synthesize their evidence. The consulted databases were Web of Science and Scopus. For the selection of articles, search equations composed of descriptors and combined qualifiers (Boolean operators) based on keywords were used. As a result, the most cited papers in high-impact journals were identified on current trends and future challenges of the FL. Then, a summary of all the evidence found in previous studies was compiled. In addition, the surveys that were applied to different populations were analyzed. Furthermore, a first multiple-choice questionnaire was developed, composed of twenty questions, with equal number of items for each of the four dimensions of Knowledge, Capacity, Information and Consciousness. The questionnaire was adapted based on the researchers experience and the characteristics of the study population.

The questionnaire was reviewed by an expert panel. The panel of experts made valid suggestions that helped us to improve the questions and adapt them to the profile of different participants. They evaluated the precision, adequacy, the understanding of the questions, the alternatives to answer, the balance between questions and dimensions, financial concepts, and other aspects.

Then, the questionnaire was applied to a pilot sample, made further adjustments to it and tested for convergence and discriminatory properties, and finally approved it for using.

Description of Field Work

The improved questionnaire was applied to the enrolled students in the first semester of the MBA program. A relevant characteristic of the questionnaire was the random order of the questions regarding the four dimensions: knowledge, capacity, information and consciousness.

The instrument was administered using Google Forms, with the prior coordination and authorization of the Head's Office of the MBA program. The instructions of the questionnaire indicated that it was anonymous, confidential and voluntary. The estimated time to answer it was fifteen minutes and it was carried out via Zoom. Likewise, besides the twenty questions about the four dimensions, five questions were added to identify the demographic information of the sample: gender, profession, age, mean gross monthly income and number of dependents. The information was saved in the digital files of Google Suite, in an Excel database, with restricted access to only the researchers of this study.

The questionnaire was administered to 321 students of eight MBA cohorts. Responses were received from 241 valid questionnaires. Table 1 shows examples of the type of questions.

Table 1. Type of question per dimension

Dimension	Dimension Focus	Type of question	Objective	Keyword
Knowledge	Understanding the basic financial concepts for personal decision-making and development of personal plans	Assume you have S/10,000 in a Savings Account and the interest rate you receive is 3 % compoundable annually. After three years, how much would you have in your account if you did not withdraw money until the date of expiration? **a. Over S/ 10,900** b. Exactly S/ 10,900 c. Under S/ 10,900 d. I do not know	Test the knowledge of the interviewee about compounding interest rate.	Compounding interest rate.

Capacity	Putting into practice the financial knowledge	Fund 3, managed by the AFPs, is expected to have a higher return compared to the Fund 2. This means that members of the Fund 2 assume: **a. Less risk that Fund 3** b. Similar risk as Fund 3 c. Higher risk that Fund 3 d. No risk	To test the knowledge of the interviewee about the risk/return relationship.	Risk and return
Consciousness	Testing individual abilities to weigh different results for their personal benefit.	Different risk positions can be adopted when investing in the Stock Market: conservative, moderate and aggressive. If you have a surplus of money, in which of the following alternatives would you invest, if your aim is moderate risk position: a. Shares of mining companies b. Shares of a company with the lowest volatility in the last 12 months c. Shares of a company with the highest profitability in the last 12 months **d. Mutual Fund with a passive portfolio diversified according to the stock market index**	To test the risk consciousness of the interviewee	Risk diversification
Information	Monitoring the current economic-financial situation and environment perspectives	In Peru, the responsible of Monetary Policy is: a. Printing and Mint Money House b. Ministry of Economy and Finance **c. Central Reserve Bank of Peru** d. Superintendency of Banking, Insurance and AFP	Test if the interviewee acquaintance with the institution responsible for the Monetary Policy in Peru	Monetary Policy
The option in **"bold"** is the right answer				

Source: Own

Research questions and hypotheses

The main objectives of the research are to estimate and analyze the FL level of professionals oriented to business management. The research faced the limitation of the absence of studies related to the population of interest; therefore, therefore, there were no standards of comparison. This was partially compensated with the definition of these standards based on our teaching experience and some literature references.

In terms of the analysis, the results were reviewed and exanimated under two perspectives: (1) dimensions involved in the definition of FL and (2) demographic characteristics of the population. The analysis aimed to explain the differences in the FL performance according to the dimensions of the concept and the demographic characteristics of the population of interest.

There were two main questions in the research: (1) what is the FL level of the population studied and how this level is decomposed in the different dimensions of the concept? (2) What demographic characteristics explain the differences in FL among the individuals of the population studied?

In conceptual terms, the null hypotheses of the research were structured in three areas: (a) Global Approach, (b) Demographic Approach, and (c) Dimensional-demographic Approach, which are explained below:

1.1. Global Approach

Null hypothesis on the general level of FL:

$H1_0$: The FL level and its different components are not higher than 75 % of their corresponding maximum score of the measurement instrument. Specifically, the mean levels of FL ($H1\text{-}0_0$), Knowledge ($H1\text{-}1_0$), Capacity ($H1\text{-}2_0$), Consciousness ($H1\text{-}3_0$), and Information ($H1\text{-}4_0$) do not exceed the 75 % of the corresponding maximum levels of the questionnaire.

Behind this null hypothesis, which was intended to be rejected, there is a statement about the FL level of the population of professionals oriented to management. For this purpose, a minimum of 15 points in the total score of the instrument (75 % of 20) and 3.75 points for each of its dimensions (75 % of 5) were considered appropriate. As referred, these minimum scores were defined based on the researcher experiences and the levels reported by the scientific literature for other populations. "We consider people to be financially literate if they know at least three out of four concepts" (Klapper, Lusardi, 2020).

To test these hypotheses, the first moment of the distribution of the sample mean and the confidence intervals for the mean scores of each dimension were considered as test statistics.

Additionally, hypotheses aim to draw conclusions regarding possible imbalances between the different dimensions of FL were tested, for this, null hypothesis on the level of differences among the different FL components were formulated:

$H2_0$: There are no significant differences between the means of FL levels among the different dimensions of the concept: Knowledge, Capacity, Consciousness and Information

These hypotheses were tested based on the confidence intervals of the estimated mean scores for each FL component.

1.2. Demographic Approach

The aim is to analyze the influence of different demographic characteristics (age, income, dependents, profession and gender) on the FL differences in the population studied. A linear regression analysis was used to control the influences of each other characteristic on the relationship of the characteristic of interest with the level of FL. In this sense, the estimation of the linear regression does not aim to "predict" the FL level according to the demographic characteristics. It aims to validate if these variables influence on the explanation of the variations in the overall FL score, as well as the magnitude of this influence.

$H3_0$: The demographic characteristics do not influence the explanation of FL level.

$H4_0$: There are no differences in the FL level due to the age of the population subjects.

$H5_0$: There are no differences in the FL level due to the income of the population subjects.

$H6_0$: There are no differences in the FL level due to the number of dependents of the population subjects.

$H7_0$: There are no differences in the FL level due to the profession of the population subjects.

$H8_0$: There are no differences in the FL level due to the gender of the population subjects.

1.3. Dimensional-demographic Approach

These hypotheses are referred to the possible differences in the FL dimensions, as a result of the demographic differences. Compared to the previous hypotheses referred to the overall FL score, these hypotheses are referred to each individual dimension. Moreover, unlike the previous hypotheses, the statistical analysis was based on a test of mean differences. The previous correlational analysis was not considered, and acknowledged the limitation on the control of possible influences of third variables. This change in the statistic technique was made due to the limited dispersion of the score values, from 0 to 5, which are different from the overall score, from 0 to 20.

For this hypothesis, each demographic characteristic was grouped in two categories, as shown below in Table 2:

Table 2. Demographics

a. Age	Junior (0)	35 years old or younger
	Senior (1)	Over 35 years
b. Income (monthly)	Lower (0)	S/10,000 or less
	Upper (1)	More than S/ 10,000
c. Number of Dependents	Without (0)	Without dependents
	With (1)	With dependents
d. Profession	Engineering (0)	Not related to management. Basically Engineering.
	Administration (1)	Related to management:

		Administrations, Economics, Accounting
e. Gender	Fem (0)	Female
	Male (1)	Male

Source: Own

$H9_0$: Mean levels of FL in Knowledge dimension shows no differences between the two the categories of Age ($H9\text{-}1_0$), the two categories of Income ($H9\text{-}2_0$), the two categories of Dependents ($H9\text{-}3_0$), the two categories of Profession ($H9\text{-}4_0$) and the two categories of Gender ($H9\text{-}5_0$).

$H10_0$: Mean levels of FL in Capacity dimension shows no differences between the two categories of Age ($H10\text{-}1_0$), of Income ($H10\text{-}2_0$), of Dependents ($H10\text{-}3_0$), of Profession ($H10\text{-}4_0$), and of Gender ($H10\text{-}5_0$).

$H11_0$: Mean levels of FL in Consciousness dimension shows no differences between the two categories of Age ($H11\text{-}1_0$), of Income ($H11\text{-}2_0$), of Dependents ($H11\text{-}3_0$), of Profession ($H11\text{-}4_0$), and of Gender ($H11\text{-}5_0$).

$H12_0$: Mean levels of FL in Information dimension shows no differences between the two categories of Age ($H12\text{-}1_0$), of Income ($H12\text{-}2_0$), of Dependents ($H12\text{-}3_0$), of Profession ($H12\text{-}4_0$), and of Gender ($H12\text{-}5_0$).

Financial literacy evaluation

Summary of the sample data

Demographic characteristics of the sample is shown in Table 3.

Table 3. Sample demographic characteristics

Total number of sample units:	241	
Gender:	Female (37.34 %) Male (62.66 %)	
Profession:	Administration, economics and accounting (39.83 %) Engineering and others (60.17 %)	
Age	Mean:	35.34 years
	SD:	6.19 years
	Minimum:	28 years
	Maximum:	53 years
Gross monthly income	Mean:	S/ 9,977
	SD:	S/ 4,864
	Minimum:	S/ 5,500
	Maximum:	S/ 22,500
Number of dependents:	Mean:	1.2282 individuals
	SD:	1.2949 individuals
	Minimum:	0 individuals
	Maximum:	4 individuals

Source: Own

Thus, the "Typical" individual of the sample is male, in the first stage of adulthood, of the engineering profession, with an income of around S/.10,000 and with a dependent.

Table 4 provides a summary of the scores obtained by the sample units, considering the following:

a. Notation for FL and its dimensions: FL (Y), Knowledge (YCO), Capacity (YCA), Consciousness (YCN), Information (YI). Demographic characteristics: Age (X_1), Income (X_2), Dependents (X_3), Profession (X_4), Gender (X_5).

b. Only two categories are considered for the different demographic characteristics, identified as 0 and 1 in the previous section.

c. The total score ranges from 0 to 20 points, and for each dimension from 0 to 5 points. The total score of each sample unit is obtained through the sum of the scores obtained in each dimension.

Table 4 shows the following:

a. Number and percentage of subjects in the two categories (0 and 1) for each demographic characteristic.

b. Mean score for each category of each demographic characteristic, for each dimension.

c. Mean score for each dimension and for the total score.

Table 4 shows the following results:

a. The sample size is 241 subjects or observations. The categories for each demographic characteristic are, relatively, balanced; with the largest imbalance of 37% and 63%.

b. A total mean FL score of Y = 13.5447 was found, which would represent a mean passing grade, but below the acceptable. The distribution of this total mean score, in its 4 dimensions, shows that the Information dimension has the best performance (YI = 4.0539) and the Capacity dimension, the lowest performance (YCA = 2.0913). This shows a failed mean level for the ability to use financial concepts and tools and a passing mean level for the ability to monitor the situation and prospects of the economic-financial environment. The other two dimensions register low passing evaluations, above 3 but below 4 points.

c. Each category of each demographic characteristic registers total mean scores above 13, lower or slightly higher than 14, and below 15, which is the level considered as acceptable. In each of the demographic characteristics, category 1 obtained a FL total mean score higher than category 0. This higher mean score tends to reproduce in each of the dimensions as well, but there are some exceptions.

d. The failed score for the Capacity dimension for the total units of the sample is reproduced in each category of each demographic characteristic. The opposite occurs with the Information dimension, where all the categories of all the characteristics obtain a score higher than 3.98, reaching above the mark of 4.13 in some cases. The other two dimensions show low passing scores in the different categories, for the different demographic characteristics, in the different dimensions of FL.

e. The best performing demographic category is the Upper category in the Income characteristic and the lowest performing category is the one without dependents.

Table 4. Summary of Sample Data

		Number	YCO Mean	YCA Mean	YCN Mean	YI Mean	Y Mean
X1	Junior (0)	134 56 %	3.7388	2.0075	3.6716	4.0000	13.4179
	Senior (1)	107 44 %	3.7850	2.1963	3.6075	4.1215	13.7103
X2	Lower (0)	152 63 %	3.5921	2.0263	3.6184	3.9868	13.2237
	Upper (1)	89 37 %	4.0449	2.2022	3.6854	4.1685	14.1011
X3	Without (0)	101 42 %	3.7327	1.9307	3.4851	3.9802	13.1287
	With (1)	140 58 %	3.7786	2.2071	3.7571	4.1071	13.8500
X4	Eng. (0)	145 60 %	3.6690	2.0759	3.5034	4.0000	13.2483
	Adm. (1)	96 40 %	3.8958	2.1146	3.8542	4.1354	14.0000
X5	Female (0)	90 37 %	3.7333	1.9667	3.6556	4.1222	13.4778
	Male (1)	151 63 %	3.7748	2.1656	3.6358	4.0132	13.5894
Total Sample		241 100 %	3.7593	2.0913	3.6432	4.0539	13.5477

Source: Own

Table 5 provides the correlation matrix between Xs and Y, as well as between the Xs. For this purpose, we worked with the original demographic variables, without grouping them into two categories. In this regard, we need to be careful with the interpretations of X_4 (Profession) and

X_5(Gender) which are dummy variables, categorical variables, and not ratio variables. It is presented for completeness.

Table 5 shows the following:

a. The correlations of the demographic variables with the FL score are low in magnitude and only the categories of Income (X_2) and Profession (X_4) (categorical variable) show estimates with statistical significance of 5 %. Therefore, when the regression analysis is used, its relevance will be limited to detecting possible links of statistical significance, but low in magnitude. In other words, the technique is used from an estimation point of view, not a prediction point of view (Hill et al., 2011: 135).

b. Regarding the variables referring to demographic characteristics, Age (X_1), Income (X_2) and Dependents (X_3) show significant correlations higher than 0.3 and lower than 0.5. They are the largest correlations in magnitude. In general, there were no high correlations between the Xs, so no major multicollinearity problems are expected.

Table 5. Correlations of FL scores#

	Y	X1	X2	X3	X4#	X5#
Y	1.0000*					
X1	0.1227	1.0000*				
X2	0.1741*	0.3902*	1.0000*			
X3	0.0562	0.4917*	0.3174*	1.0000*		
X4#	0.1317*	-0.1784*	-0.1271*	-0.0781	1.0000*	
X5#	0.0193	0.1680*	0.1802*	0.2094*	-0.1428*	1.0000*

Source: Own

#: When reading the table, be careful with X4 and X5, which are dummy variables, categorical variables, and not ratio variables.

*: Significance level of 5 % (Null hypothesis: the correlation is 0)

Global Approach Analysis ($H1_o$ and $H2_o$)

This section tests the hypotheses related to the general population, without differentiating by demographic characteristics. Specifically, the total score and the score of each dimension were considered. Table 6 shows the statistics regarding these scores:

- Row 1: Number of observations
- Row 2: Mean
- Row 3: Standard Deviation (SD)
- Row 4: Standard error (SE)
- Row 5: Target Score (TS)
- Row 6: t-test statistic = (Mean – TS) / SE
- Row 7: Degrees of freedom (Number of observations – 1)
- Row 8: p-value (Right tailed test)

For the null hypothesis $H1_o$ the following generic statement is proposed:

$H1_o$: Mean score of YYY of professionals interested in business management is not higher than XXX.

Where: YYY has the following meanings: FL, Knowledge, Capacity, Consciousness, Information. As for XXX, the values were 15 for FL and 3.75 for the other YYY.

The test statistic for these hypotheses is the mean, through the respective t-value of the Student's distribution of N - 1 = 240 levels of freedom. The assumption of normality of the mean distributions is based on the central limit theorem and the sample size.

Table 6 shows these hypotheses tests. Considering a significance level of 5 %, hypotheses $H1\text{-}0_o$, $H1\text{-}1_o$, $H1\text{-}2_o$ and $H1\text{-}3_o$ were rejected. Hypothesis $H1\text{-}4_o$ could not be rejected. Therefore, it could not be assumed that the population studied shows an acceptable level of FL. Likewise, the levels of Knowledge, Capacity and Consciousness did not show levels that could be considered acceptable. The Information dimension did obtain an acceptable level. In other words, the population interested in business management showed an acceptable behavior in terms of monitoring the economic-financial environment. This can be explained by the interest in management issues that encourages the monitoring of the environment related to economics and finance, as well as an effort to understand it,

despite the limitations in the other FL dimensions. This understanding of the environment could be greatly enhanced with a better competence in the other three dimensions.

Table 6. Hypothesis Tests $H1_o$

	FL (Y)	Knowledge (YCO)	Capacity (YCA)	Consciousness (YCON)	Information (YI)
1. Number of Observations	241	241	241	241	241
2. Mean	13.5477	3.7593	2.0913	3.6432	4.0539
3. SD	2.8001	1.1727	1.2583	1.0069	0.7425
4. SE	0.1804	0.0755	0.0811	0.0649	0.0478
5. Target Score (TS)	15	3.75	3.75	3.75	3.75
6. t-test statistic	-8.0504	0.1232	-20.4525	-1.6456	6.3577
7. Levels of Freedom	240	240	240	240	240
8. p-value	1.0000	0.4510	1.0000	0.9494	0.0000

Source: Own

The above conclusion allowed us to draw the respective implications for hypothesis H2; however, this hypothesis was formally tested. This hypothesis test was based on the statistical confidence interval.

Table 7 shows the confidence interval estimates for the scores of FL and of its dimensions.

Table 7. Confidence Intervals for the FL dimension scores

	FL (Y)	Knowledge (YCO)	Capacity (YCA)	Consciousness (YCON)	Information (YI)
Number of Observations	241	241	241	241	241
Mean	13.5477	3.7593	2.0913	3.6432	4.0539
SD	2.8001	1.1727	1.2583	1.0069	0.7425
SE	0.1804	0.0755	0.0811	0.0649	0.0478
Degrees of Freedom	240	240	240	240	240
t-critical (95 %, two-tailed)	1.9699	1.9699	1.9699	1.9699	1.9699
Error	0.3553	0.1488	0.1597	0.1278	0.0942
Lower Limit	13.1924	3.6105	1.9316	3.5154	3.9597
Higher Limit	13.9030	3.9081	2.2510	3.7709	4.1482

Source: Own

Table 7 shows the following:

a. The FL mean level, under a Confidence Level of 95 %, was between 13 and 14, which shows a deficiency in respect to the acceptable level of 15, in this important competence.

b. The best performance is in the Information dimension and the lowest performance is in the Capacity dimension. The latter did not reach a passing level. Thus, at 95 % of confidence, the estimate of the mean of the Capacity competence is between 1.9316 and 2.2510, an interval below the mark of 2.5 points. The Knowledge and Consciousness dimensions have similar intervals for their means, between 3.6105 and 3.9081, and between 3.5154 and 3.7709, respectively. These intervals have a passing level, but lower compared to the Target Score of 3.75 level; only the upper end of the interval for Consciousness is 2 hundredths of points above the mark of 3.75. Therefore, the hypothesis of a balanced development of FL is rejected, in terms of its different dimensions, through the confidence interval statistic. At 95 % confidence, the intervals for the Capacity and Information dimensions did not intersect with each other, neither with those of the Knowledge and Consciousnes dimensions.

The following are the confidence intervals for the mean score:

YI > Acceptable > YCO and YCON > Failed > YCA

A balanced development of the FL dimensions was not found. This is due to the higher performance of the Information dimension for possible explanations already mentioned above and the lower performance of the Consciousness dimension. This low performance of the Capacity dimension indicated a lack of emphasis on training in the use of the acquired knowledge.

Demographic Approach Analysis

This section analyzes the possible relevance of demographic characteristics as explanatory variables for differences in the total FL score. The interest is not focused on the magnitude of the explanatory power of these factors, but rather on identifying whether they play a role or not. This is relevant in terms of the continuing academic and social interest of the role of these factors and their effects on various topics of the human endeavor.

For this purpose, the regression analysis technique was used to estimate the effects of one factor, controlling the effects of the other factors. Based on this methodology, we tested hypotheses $H3_0$, $H4_0$, $H5_0$, $H6_0$, $H7_0$ and $H8_0$.

The regression model used was:

$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \varepsilon$

Null hypotheses were:

$H3_0$: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$

$H4_0$: $\beta_1 = 0$

$H5_0$: $\beta_2 = 0$ (X_2 in thousands of soles)

$H6_0$: $\beta_3 = 0$

$H7_0$: $\beta_4 = 0$

$H8_0$: $\beta_5 = 0$

Standard assumptions for ordinary minimum squares regression were checked and no problems were found.

Table 8. Results of the Regression Model Estimation

				Confidence Interval 95 %	
	Estimate	Standard Error	p-value	Lower values	Upper values
1. Observations	241				
2. R^2	0.0620				
3. Ajusted R^2	0.0421				
4. Typical Error	2.7405				
5. F	3.1082		0.0098		
6. β_0	10.6124	1.1535	0.0000	8.3400	12.8849
7. β_1	0.0476	0.0346	0.1693	-0.0204	0.1157
8. β_2	0.0951	0.0403	0.0191	0.0157	0.1744
9. β_3	-0.0769	0.1603	0.6320	-0.3927	0.2390
10. β_4	0.9658	0.3697	0.0096	0.2375	1.6941
11. β_5	0.0201	0.3789	0.9577	-0.7263	0.7665

Source: Own

Table 8 shows the results of the regression model estimation. As expected from the correlations between each explanatory variable and the explained variable, there is a low adjustment of the model to the data, as can be seen in the low level of the coefficient of determination R^2 and the adjusted R^2. However, the F-statistic value, with a p-value of 0.0098, indicates that the model does explain the data obtained; that is, not all the βs are null. Therefore, the null hypothesis $H3_0$ is rejected, and concluded that the demographic characteristics have an influence on the explanation of FL.

For each demographic characteristic, through their respective p-values, for a 5 % statistical significance, it is concluded that the null hypotheses $H4_0$ (Age), $H6_0$ (Dependence) and $H8_0$ (Gender) cannot be rejected. These results conclude that it cannot be affirmed that there are differences in the FL score based on the age, dependence and gender. On the other hand, the p-values allowed rejecting the null hypotheses $H5_0$ (Income) and $H7_0$ (Profession) and conclude that these characteristics do have relevance in the explanation of the differences in FL scores.

To analyze the two variables of income and profession, the regression model was adjusted and the variables that lacked statistical significance were eliminated. A progressive process of successive estimates of the linear regression model was followed, eliminating variables without statistical significance, one variable at a time, until a model was reached where all the variables reached a statistical significance of 5 %. The order in which non-significant variables were eliminated considered as criteria the sign of the estimate and the magnitude of the p-value. The order resulting from this process was dependence, gender and age. Therefore, it ended up with the following regression model:

$Y = \beta_0 + \beta_2 X_2 + \beta_4 X_4 + \varepsilon$

The variable X_2 refers to income in thousands of soles and X_4 to the dummy variable of profession.

Results are shown in Table 9.

Table 9. Estimates of the Regression Model based on the Income and Profession Variables

				Confidence Interval 95 %	
	Estimate	Stand. Error	p-value	Lower values	Upper values
1. Observations	241				
2. R^2	0.0544				
3. Ajusted R^2	0.0464				
4. Typical Error	2.7343				
5. F	6.8403		0.0013		
6. β_0	12.0782	0.4456	0.0000	11.2004	12.9560
7. β_2	0.0001	0.0000	0.0025	0.0000	0.0002
8. β_4	0.8925	0.3627	0.0146	0.1779	1.6070

Source: Own

Table 9 presents a low R^2, but the F-test ratifies the relevance of the model in the explanation of FL. The explanatory variables Income and Profession show statistical significance; however, the importance of the Income variable is nil, therefore, it was not considered in the following analysis.

Regarding the profession dummy variable (X_4), its estimated slope was 0.8924. This means that a professional related to the business administration area, compared to engineering professionals (other professions have marginal numbers) produced an increase in the total score of 0.8924; that is, less than 1 point. This is a relevant result. The administration major, compared to the engineering major, represents less than a one-point difference in FL. This may be a reasonable indication of a serious limitation in the training of management professionals in terms of generating natural and habitual financial thinking skills for situations involving analysis of personal financial issues. Academic training in administration may be educating efficient professionally individuals, but with limited effects in terms of FL. This result may have broader implications; it could be an indicator that the training of these professionals is carried out with serious limitations regarding the generation of competencies and skills beyond the aspect of technical training and acquisition of knowledge and skills for professional methodologies and procedures.

Dimensional-Demographic Analysis

This section discusses the analysis of the different dimensions of FL in order to determine possible differences between the categories of each demographic characteristic. A regression analysis has not been used due to limitations of the measurement scale for each dimension, which only takes integer values from 0 to 5.

The null hypotheses clusters for $H9_0$ (Knowledge), $H10_0$ (Capacity), $H11_0$ (Consciousness) and $H12_0$ (Information) are specifically tested. Within each of these clusters, there are 5 hypotheses for each of the 5 demographic characteristics. In these hypotheses, the scores of the two categories of each demographic characteristic were compared for each dimension. The sample mean is used as the test statistic, through the respective Student's t-test. The assumption of normality of distribution of the sample mean is guaranteed by the central limit theorem and the sample size.

The tests have the following standard format:

Ho: $\mu_1 - \mu_0 = 0$

Where, μ_o is the population mean of category 0 of the considered demographic characteristic, for the analyzed dimension. In the same way for μ_1.

The test statistic is

$$t = \frac{(\bar{x}_1 - \bar{x}_0) - (\mu_1 - \mu_0)}{\sqrt{\frac{s_0^2}{n_1} + \frac{s_1^2}{n_2}}}$$

Where $\bar{x}_i$ are the sample means, s_i^2 are the sample variances and n_i are the sample sizes.

The levels of freedom of the student's distribution are estimated as follows:

$$df = \frac{(\frac{s_0^2}{n_0} + \frac{s_1^2}{n_1})^2}{(\frac{(\frac{s_0^2}{n_0})^2}{n_0 - 1} + \frac{(\frac{s_1^2}{n_1})^2}{n_1 - 1})}$$

The p-value defined by the t-statistic was contrasted against a significance level of 0.05.

Tables 10-14 show the results for the characteristics Age (X_1), Income (X_2), Dependency (X_3), Profession (X_4) and Gender (X_5), respectively. Each column of these tables corresponds to a dimension of the FL: Knowledge, Capacity, Consciousness and Information. The rows are organized in three blocks of information; the first block refers to sample data corresponding to category 0, the second block to category 1 and the third block to the hypotheses test. The first two blocks, used for the categories, show the mean estimate and its corresponding 95 % confidence interval.

Table 10. Age. Scores for each Dimension and Hypotheses Test

	Knowledge YCO	Capacity YCA	Consciousness YCN	Information YI
Category 0: Junior				
Number of observations	134	134	134	134
Mean	3.7388	2.0075	3.6716	4.0000
SD	1.2258	1.2832	1.0389	0.7559
Standard error (SE)	0.1059	0.1109	0.0897	0.0653
t-critical 95% (two-tailed)	1.9780	1.9780	1.9780	1.9780
Error	0.2095	0.2193	0.1775	0.1292
Lower limit (at 95%)	3.5293	1.7882	3.4941	3.8708
Upper limit (at 95%)	3.9483	2.2267	3.8492	4.1292
Category 1: Senior				
Number of observations	107	107	107	107
Mean	3.7850	2.1963	3.6075	4.1215
SD	1.1077	1.2243	0.9689	0.7231
Standard error (SE)	0.1071	0.1184	0.0937	0.0699
t-critical 95 % (two-tailed)	1.9826	1.9826	1.9826	1.9826
Error	0.2123	0.2347	0.1857	0.1386
Lower limit (95 %)	3.5727	1.9616	3.4218	3.9829
Higher limit (at 95 %)	3.9973	2.4309	3.7932	4.2601
Hypothesis Test	$H9\text{-}1_o$	$H10\text{-}1_o$	$H11\text{-}1_o$	$H12\text{-}1_o$
Degrees of Freedom	235	232	233	231
t-test statistic	0.3070	1.1643	-0.4946	1.2701
p-value	0.7591	0.2455	0.6213	0.2053
Rejection decision at 5 %	NO	NO	NO	NO

Source: Own

Table 11. Income. Scores for each Dimension and Hypotheses Test

	Knowledge YCO	Capacity YCA	Consciousness YCN	Information YI
Category 0: Lower				
Number of observations	152	152	152	152
Mean	3.5921	2.0263	3.6184	3.9868
SD	1.2307	1.2068	1.0095	0.8055
Standard error (SE)	0.0998	0.0979	0.0819	0.0653
t-critical 95 % (two-tailed)	1.9758	1.9758	1.9758	1.9758
Error	0.1972	0.1934	0.1618	0.1291
Lower limit (at 95 %)	3.3949	1.8329	3.4566	3.8578
Upper limit (at 95 %)	3.7893	2.2197	3.7802	4.1159
Category 1: Upper				
Number of observations	89	89	89	89
Mean	4.0449	2.2022	3.6854	4.1685
SD	1.0103	1.3415	1.0067	0.6075
Standard error (SE)	0.1071	0.1422	0.1067	0.0644
t-critical 95 % (two-tailed)	1.9873	1.9873	1.9873	1.9873
Error	0.2128	0.2826	0.2121	0.1280
Lower limit (at 95 %)	3.8321	1.9197	3.4733	4.0406
Upper limit (at 95 %)	4.2578	2.4848	3.8975	4.2965
Hypothesis Test	$H9\text{-}2_0$	$H10\text{-}2_0$	$H11\text{-}2_0$	$H12\text{-}2_0$
Degrees of Freedom	213	169	185	224
t-test statistic	3.0931	1.0191	0.4979	1.9807
p-value	0.0022	0.3096	0.6191	0.0488
Rejection decision at 5 %	YES	NO	NO	YES

Source: Own

Table 12. Dependents. Scores for each Dimension and Hypotheses Test

	Knowledge YCO	Capacity YCA	Consciousness YCN	Information YI
Category 0: Without Dependents				
Number of observations	101	101	101	101
Mean	3.7327	1.9307	3.4851	3.9802
SD	1.1991	1.1769	1.1191	0.8122
Standard error (SE)	0.1193	0.1171	0.1113	0.0808
t-critical 95 % (two-tailed)	1.9840	1.9840	1.9840	1.9840
Error	0.2367	0.2323	0.2209	0.1603
Lower limit (at 95 %)	3.4960	1.6984	3.2642	3.8199
Upper limit (at 95 %)	3.9694	2.1630	3.7061	4.1405
Category 1: With Dependents				
Number of observations	140	140	140	140
Mean	3.7786	2.2071	3.7571	4.1071
SD	1.1572	1.3058	0.9046	0.6859
Standard error (SE)	0.0978	0.1104	0.0765	0.0580
t-critical 95 % (two-tailed)	1.9772	1.9772	1.9772	1.9772
Error	0.1934	0.2182	0.1512	0.1146
Lower limit (at 95 %)	3.5852	1.9889	3.6060	3.9925
Upper limit (at 95 %)	3.9719	2.4253	3.9083	4.2218
Hypothesis Test	$H9\text{-}3_0$	$H10\text{-}3_0$	$H11\text{-}3_0$	$H12\text{-}3_0$
Degrees of Freedom	211	227	187	193
t-test statistic	0.2975	1.7180	2.0137	1.2764

p-value	0.7664	0.0872	0.0455	0.2033
Rejection decision at 5 %	NO	NO	YES	NO

Source: Own

Table 13. Profession. Scores for each Dimension and Hypotheses Test

	Knowledge YCO	Capacity YCA	Consciousness YCN	Information YI
Category 0: Engineering				
Number of observations	145	145	145	145
Mean	3.6690	2.0759	3.5034	4.0000
SD	1.1729	1.2643	0.9727	0.7906
Standard error (SE)	0.0974	0.1050	0.0808	0.0657
t-critical 95 % (two-tailed)	1.9766	1.9766	1.9766	1.9766
Error	0.1925	0.2075	0.1597	0.1298
Lower limit (at 95 %)	3.4764	1.8683	3.3438	3.8702
Upper limit (at 95 %)	3.8615	2.2834	3.6631	4.1298
Category 1: Administration				
Number of observations	96	96	96	96
Mean	3.8958	2.1146	3.8542	4.1354
SD	1.1651	1.2555	1.0258	0.6589
Standard error (SE)	0.1189	0.1281	0.1047	0.0672
t-critical 95 % (two-tailed)	1.9853	1.9853	1.9853	1.9853
Error	0.2361	0.2544	0.2078	0.1335
Lower limit (at 95 %)	3.6598	1.8602	3.6463	4.0019
Upper limit (at 95 %)	4.1319	2.3690	4.0620	4.2689
Hypothesis Test	H9-4_0	H10-4_0	H11-4_0	H12-4_0
Degrees of Freedom	205	205	196	227
t-test statistic	1.4759	0.2337	2.6523	1.4409
p-value	0.1415	0.8154	0.0087	0.1510
Rejection decision at 5%	NO	NO	YES	NO

Source: Own

Table 14. Gender. Scores for each Dimension and Hypotheses Test

	Knowledge YCO	Capacity YCA	Consciousness YCN	Information YI
Category 0: Female				
Number of observations	90	90	90	90
Mean	3.7333	1.9667	3.6556	4.1222
SD	1.1689	1.1062	0.9500	0.7162
Standard error (SE)	0.1232	0.1166	0.1001	0.0755
t-critical 95 % (two-tailed)	1.9870	1.9870	1.9870	1.9870
Error	0.2448	0.2317	0.1990	0.1500
Lower limit (at 95 %)	3.4885	1.7350	3.4566	3.9722
Upper limit (at 95 %)	3.9782	2.1983	3.8545	4.2722
Category 1: Male				
Number of observations	151	151	151	151
Mean	3.7748	2.1656	3.6358	4.0132
SD	1.1785	1.3388	1.0423	0.7571
Standard error (SE)	0.0959	0.1090	0.0848	0.0616
t-critical 95 % (two-tailed)	1.9759	1.9759	1.9759	1.9759
Error	0.1895	0.2153	0.1676	0.1217
Lower limit (at 95 %)	3.5853	1.9503	3.4682	3.8915

Upper limit (at 95 %)	3.9643	2.3808	3.8034	4.1350
Hypothesis Test	$H9\text{-}5_0$	$H10\text{-}5_0$	$H11\text{-}5_0$	$H12\text{-}5_0$
Degrees of Freedom	188	215	201	196
t-test statistic	0.2658	1.2464	-0.1508	-1.1183
p-value	0.7907	0.2140	0.8803	0.2648
Rejection decision at 5 %	NO	NO	NO	NO

Source: Own

Based on the information in the tables, it is concluded that with a statistical significance level of 5 %, there are no significant differences in the FL scores in any of the dimensions between the two categories considered due to age.

Regarding the two Income categories, there are differences at the significance level of 5 % in terms of better performance for the Upper category, and also in the Knowledge and Information dimensions, but not in the Capacity and Consciousness dimensions.

As for the characteristics of the Dependents categories, the population with dependents showed a higher performance than the population without dependents at the statistical significance of 5 %. In the other dimensions, no statistically significant difference could be considered between the two population categories.

For the Profession dimension, the Administration population showed a performance higher than the Engineering population, within the Consciousness dimension, at 5 % statistical significance. For the other dimensions, it was not possible to reject the hypotheses of equality in the means.

No statistically significant differences were detected in the category of gender.

3. Conclusion

The level of FL in the population of professionals interested in management has been studied in detail. The importance of this population is related to the homogeneity factor, given their interest in a professional field, where financial thinking and skills are highly important; for the relevance of the age for the study of FL and for the characteristics of modern life. The population is also important because it can be used for comparison purposes with other populations.

The results obtained were lower than expected for this professional segment. The mean performance in the total score was below the 75 % of the maximum potential score. The results were similar for the other dimensions, except for the Information dimension. This may draw attention, since the evolution of FL in individuals is expected to follow sequentially the sophistication in the involved dimensions: Knowledge, Capacity, Information and Consciousness. However, the only acceptable score was in the Information dimension. How is it possible that with low scores in the first two basic dimensions, an acceptable score is obtained in the third dimension? This can be explained by the main characteristic of the population: the interest in management. The result would indicate a limited education and training in basic topics, such as the concepts (Knowledge) and their use (Capacity), which is compensated by the interest in management topics. This interest encourages these professionals to follow the evolution of the economic-financial environment through different means of dissemination of news and information; this keeps them informed and generates skills for self-training. Therefore, there is a great deal of work to be done in the basic training of these professionals, which would allow them to understand better this economic-financial environment.

The Capacity dimension obtained the lowest performance and a failing grade, which has to do with skill to use knowledge and concepts in specific situations. This would indicate that the training of the population does not emphasize the aspects of use and employment of the knowledge acquired. Care must be taken here to distinguish between the use of such knowledge in the profession and the use at the individual's personal level. FL is targeted at the personal level, at the natural, habitual behavior of the individual in matters involving financial perspectives. This population of professionals interested in management may have the basis for a good professional performance based on learned methodologies and procedures, but which have not been internalized in their personal thinking and behavior. In other words, there may be a situation of a separation between professional and personal skills in finance.

These conclusions regarding the performance of the population were also reflected in the results of the regression analysis performed. This analysis was conducted to identify possible

demographic differences in FL scores. In general, in terms of impact, a lower explanatory power was obtained; however, the F test did indicate that the model was valid for explaining FL. The Income and Profession dimensions were statistically significant among the demographic variables considered. Although the Income dimension was statistically significant, its extent is very limited and it does not merit further study. The effect of the Profession generated and motivated conjectures and reflections. In practice, the sample only included two professions, those related to administration and those related to engineering. The result obtained shows that the difference between both professions is less than one point in the total score; which means that a difference of more than 4 years of academic training in management and economics is only reflected in less than one point of better performance (out of 20) between the two occupations. This limited result for the management profession is related to the arguments of the previous paragraph; there is a differentiation between what may be professional skills and personal skills in the finance area. This remark is also reflected in the analysis of the relative performance between these two professions in each of the FL dimensions. Only the Consciousness dimension showed a significant difference in this relative analysis; not in the dimensions that best differentiate the characteristics of these two occupations, such as Knowledge, Capacity and Information.

No statistically significant differences were detected between demographic groups in the performance of each FL dimension, neither by age nor by gender. Differences by income were detected in favor of the Upper category in the Knowledge and Information dimensions. To a great extent, this may be due to the need for financial skills that this economic category imposes due to the greater variety and scope of decisions. Differences were detected in the Dependency variable in favor of the "with dependents" group in the Consciousness dimension, reflecting a greater concern for the consequences of financial decisions and plans. Having dependents generates a greater consciousness, concern and sense of responsibility. Regarding the profession, as mentioned above, there were differences in favor of Administration in the dimension of Consciousness.

The important conclusions of this research allow us to make two conjectures, both of which generate incentives for future research. The first of these conjectures, the Financial Duality Conjecture, is the existence of a difference between professional skills and personal financial skills in the field of finance. In other words, professional training in finance is not necessarily indicative of financial expertise on a personal level. This opens up a number of questions as to why this may be the case. Questions ranging from possible differences in the skills involved, in the methodology used in the training of professionals and in the limitations to natural, habitual, Kahneman-like financial thinking (Kahneman, 2011). The last of these possible reasons would be linked to the limitations of System 1 and System 2 referred to by Kahneman [1] which generate biases in financial behavior.

The second conjecture, the Financial Divergence Conjecture, refers to limitations and restrictions in basic training, in the Knowledge and Capacity dimensions among management-interested individuals, generating a compensatory effect in terms of self-preparation and self-training. The orientation and interest in management motivate self-learning through the information with which the media report the evolution of the economic-financial environment, leading to the paradox of achieving an understanding of it that is not supported by basic financial concepts. This would be our best recommendation to those interested in the subject of FL, to come together to generate studies around these two conjectures.

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[1] System 1 is fast, intuitive and emotional, while system 2 is slower, deliberative and logical.

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Efficiency of Various Forms of Simulation Training in the Training of Medical Professionals

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Abstract

The purpose of the study was to investigate the effectiveness of simulation training in enhancing the knowledge and practical skills of emergency medical service (EMS) specialists. With the evolving landscape of healthcare, the demand for proficient professionals capable of managing medical emergencies has grown significantly. Universities are embracing innovative training methods, including simulation technologies, to prepare students effectively for these crucial roles. The study was conducted in the first semester of the 2021–2022 academic year, involving 120 university students in their 5th and 6th years of study. The paper sheds light on the positive effect of various types of simulation training on the level of training of emergency medical service specialists. The authors seek to demonstrate the necessity and efficiency of innovative technology in practicing practical and communication skills. Various forms of simulation training (medical team lessons, joint drills, masterclasses) are a highly efficient system of practical training for students. The results of the empirical study lead to the conclusion that various forms of simulation training (medical team lessons, joint drills, masterclasses) present a highly efficient system of practical training for students and enable students to improve their practical emergency medical care skills. Medical team classes are a priority form for practicing the algorithm of cardiopulmonary resuscitation. Joint drills are used to practice organizational and practical skills in coordinating the actions of various services in emergencies. Masterclasses should be used as an element of practical training with large audiences.

Keywords: simulation training, emergency medical care, team training, joint drills, masterclasses, mannequin, practical skills, theoretical knowledge.

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1. Introduction

The remarkable pace of scientific and technological progress in medicine (Osadchuk et al., 2021) and the emergence of modern equipment and new technologies in emergency medical services (EMS) have changed the requirements for the professional level of doctors (Korotaeva, Kapustina, 2022), students, nurses, and paramedics (Baigireyeva et al., 2021). For all the above categories of professionals (both practicing and in training), improving the level of practical skills during EMS remains a necessity (Kavalerskii, Garkavi, 2015; Kovalev et al., 2020). To address this issue, special attention should be paid to practicing the algorithm for cardiopulmonary resuscitation (CPR) and the algorithm for EMS in polytrauma and other critical conditions (Stazhadze, Spiridonova, 2008). Regrettably, the classical forms of education (lectures, seminars, discussion of the situation at the patient's bedside, etc.) do not form in students a stable algorithm of actions in critical situations (Amir, 2023; Juliani et al., 2023). Because of this, doctors and medical teams have difficulties in mobilizing quickly and automatically providing quality EMS to the victim in such situations (Kaibyshev et al., 2016).

Therefore, medical universities need to provide the training of specialists focused (Kim, Oh, 2023), among other things, on EMS in emergency conditions at the pre-hospital and early in-hospital stages (Jacobson et al., 2021). In this, the main emphasis should be placed on forming quality practical skills and abilities in EMS. We believe that the simulation form of training, in which training proceeds in a special artificial imitation environment using mannequins or models, is the most appropriate for developing the necessary skills and abilities in medical staff (Nikolaeva, Suslennikova, 2022).

In connection with the above, we pose the following research question: does the use of various forms of simulation training contribute to students' mastery of knowledge and practical skills in providing EMS?

The article is organized as follows. The next section presents a review of the literature on the problem of using simulation training in medical education, including for the consolidation of knowledge and practical skills in providing EMS. Particular attention is paid to papers analyzing the advantages of simulation training compared to the traditional system of training. Next, the research methods and the results of the study are presented and discussed. The article is closed with theoretical and practical conclusions and limitations of the study.

2. Literature review

According to H. Al-Elq Abdulmohsen (2010), simulation-based training is a training method based on the simulation of any physical process using an artificial (e.g., mechanical or computer-based) system (Korotaeva, Kapustina, 2022; Scalese et al., 2008). Clinical skills training through the use of simulation dummies, simulators, and standardized patients have been the standard of medical education in the developed world for decades (Cant, Cooper, 2010).

Training with mannequins and simulators under the teacher's observation has long been part of educational practice in many world countries, but a lot of research is still being conducted to test the efficiency of this method (Lavrinenko et al., 2022; Mokhov et al., 2022). In particular, K.B. Boyd et al. (2006) find that simulation-based training that supplements and precedes clinical training ensures a higher level of clinical competence (Yespolova et al., 2019). A study by D.L. Rodgers et al. (2009) suggests that the use of high-tech simulation methods is more effective than traditional training. P.J. Morgan and D. Cleave-Hogg (2005) note that 71 % of medical schools use some form of mannequins or simulators to teach anesthesia to medical students. Around 80 % of these institutions utilize simulation training in postgraduate education. This popularity of simulation training owes to the opportunity for objective assessment of the speed of decision-making and determining the number of mistakes throughout the training process. Furthermore, the predominant part of interns believes that simulations play an important part in their current training programs (Shapiro et al., 2004). There are numerous studies describing the use of simulators in training medical personnel of various profiles (Falcone et al., 2008; Korndorffer et al., 2005; Sedlack et al., 2007).

Simulation training has several advantages compared to the traditional system of training:

- the possibility of objective registration of the parameters of professional actions performed for each specialist to achieve a high level of training. Some simulators are equipped with an indicative perception system based on the students' actions (from a single "yes" or "no" answer to

complex feedback, for example, on the administration of a particular medication with the possibility of its registration and storage) (Crofts et al., 2007);

- development of skills with no risk for patients, especially in practicing invasive diagnostic and treatment manipulations (Nishisaki et al., 2007), reduced stress contact with the patient (Hobgood et al., 2010; Zairi et al., 2022) and independence of the work of clinics, and practicing actions in cases of rare pathologies that are not available at the time of the lesson (DeVita et al., 2005). In contrast to the traditional training system, in which a young medic can have perfect knowledge of the theory of some manipulation but no practical experience (Medeshova et al., 2022), the simulation technology allows them to practice the necessary algorithm of practical actions (Sannicandro et al., 2022) and use the obtained knowledge in the future when working with patients (Fritz et al., 2008);

- unlimited number of tries to practice the skill and eliminate mistakes. Once again, simulation technologies allow a student to repeat a particular skill until it becomes automatic, which improves their mastery and increases their level of competence (Ziv et al., 2007);

- conducting a real detailed pedagogical evaluation with an objective assessment of the achieved level of mastery (Okuda et al., 2008; Syed et al., 2021; Vorobeva et al., 2021).

The use of simulation training in disaster medicine arouses great interest among students in the training process and plays an important part in raising the professionalism of future medics (Smailov et al., 2022), as well as contributes to the assimilation of material, its quality and efficiency, and gives the opportunity to see, hear, and practice skills on a mannequin, which promotes students' motivation for training (Bolatov et al., 2022), because they are not afraid to try and make mistakes, ask questions, and speak with the teacher (Kovalev et al., 2020).

The goal of the present study is to identify the effective forms of simulation training and assess the efficiency of simulation training in teaching EMS to students.

The research objectives are:

1. To examine the positive impact of simulation training on the level of training of medical specialists, as well as the relevance and efficiency of the use of innovative technology in practicing practical skills,

2. To assess the efficiency of simulation training in teaching students to provide EMS based on an empirical study.

3. Methods

Study design. The study was conducted in the first semester of the 2021–2022 academic year. The research sample included 120 university students in their 5th and 6th years of study. The selection of students from the 5th and 6th year of study was based on the fact that students in the 5th and 6th years of study are typically in the advanced stages of their medical education, having already undergone a substantial portion of theoretical and practical training. As a result, they possess a foundational knowledge base that provides a suitable platform for assessing the impact of simulation training on further skill development.

To achieve the goal of the study a qualitative-quantitative type of research was chosen, the main method of which was testing at the formation and assessment of knowledge and practical skills of students in the provision of emergency medical care.

The study was conducted in three stages.

The first stage of the study involved initial testing of the knowledge and practical skills of students in providing EMS.

At the second stage, several forms of simulation training were utilized in the training of students to develop their knowledge and practical skills in EMS:

1. Medical team lessons. This form of simulation training is used in work with EMS teams (doctor, feldsher, nurse aide, driver), students, and paramedics. Medical team lessons proved to be highly efficient in practicing the CPR algorithm because these classes allow practicing the clarity of distribution of duties in the team during CPR; the clarity of execution of the action algorithm commands and mutual understanding in the team during the change of team members every 2-3 minutes; opportunities to bring in witnesses as potential assistants in performing CPR; leadership skills.

2. Joint drills. This form of simulation training is used to practice the organizational and practical skills of coordinating the actions of various services. It has proven to be extremely

effective during emergency response skills training. Joint drills also help improve the stress tolerance of EMS teams.

3. Masterclasses. This most popular form of simulation training was used in work with large audiences. This form of simulation training is highly effective for practicing the practical skills of EMS to victims with various types of injuries, anesthesia of patients using various methods of local anesthesia, in case of the temporary stop of external bleeding, the need to install intraosseous access, and ensuring airway patency. Masterclasses consisted of the following stages of training: 1) determining the level of clinical skills at the start of the practical lesson; 2) learning to work on moulages (demonstration, explanation); 3) individual performance (practicing); 4) examination by the teacher of the level of practical skills mastery (discussion, evaluation); 5) teamwork (staging, interdisciplinary training); 6) debriefing (detailed analysis of the group's work according to the basic algorithm of actions).

In the classes, students obtained theoretical knowledge on the notion and classification of terminal states and studied the algorithms of the initial examination of a critical patient and the performance of CPR.

Students were also able to improve their practical skills in the restoration and maintenance of airway patency by noninvasive, minimally invasive, and invasive methods, performing quality chest compressions, intravenous or intraosseous administration of medications, and work with automatic external and professional defibrillators. Thus, during simulation training in different scenarios, students were trained to allocate responsibilities in the team during CPR; to understand each other during team member changes every 2-3 minutes; to ergonomically position rescuers during CPR; to use witnesses as potential assistants in CPR; to act as leaders.

The third stage involved the final testing of students' knowledge and practical skills on mannequins and dummies after the simulation training.

Data collection. During the first and third stages of the study, the following theoretical knowledge and practical skills were assessed (on mannequins and dummies):

- knowledge of the algorithm for the initial examination of a critical patient; the BLS algorithm; the basic CPR algorithm; basic medications used in CPR; causes that can lead to ineffective CPR (Kaibyshev et al., 2016; Kavalerskii, Garkavi, 2015; Stazhadze, Spiridonova, 2008);

- skills of quality performance of chest compressions; restoring airway patency; performing quality ventilation of the lungs; operating an automated external defibrillator; operating a professional defibrillator-monitor; assessing heart rate; obtaining intravenous or intraosseous access (Kavalerskii, Garkavi, 2015; Kavalerskii, Garkavi, 2015; Stazhadze, Spiridonova, 2008).

Materials. To achieve the purpose of simulation training, the study used:

1. Simon® S311 full body resuscitation mannequins; adolescent and infant CJIP mannequins (Laerdal); a mannequin for learning practical airway restoration skills Laerdal Airway Management Trainer; male arm replica with the venous network.

2. Additional equipment: AED Pro automatic external defibrillator, HeartStart MRx monitor/defibrillator (Philips); a set of air ducts to restore and maintain the passage of the respiratory tract; Rescue Pack for respiratory support; transport immobilization kit; bandaging material.

Statistical data analysis was performed using mathematical statistics methods. The mean sample values of quantitative characteristics were estimated (given in the text as M ± m, where M is the sample mean, and m is the error of the mean). The statistical significance of differences in the results of initial testing (IT) and final testing (FT) was assessed by calculating Student's t-test for connected samples.

In all statistical analysis procedures, the critical level of significance p was taken to be 0.05. Data were processed using the Statistica 6.0 application software package.

4. Results and discussion

Table 1 provides data on the assessment of the students' knowledge and practical skills before and after the use of various forms of simulation training.

Data in Table 1 demonstrate that students in the 5th and 6th years had sufficient theoretical knowledge of the basic CPR algorithm and basic medications used in advanced CPR. Students in both years of study also demonstrated sufficient practical skills in performing quality chest compression. However, before the various forms of simulation training with dummies and mannequins, 5th-year students did not have enough skills in restoring the passage of the

respiratory tract, operating automatic external or professional defibrillator, performing peripheral vein catheterization, or using intra-bone access.

Table 1. Assessment of students' knowledge and practical skills

Practical skills and theoretical knowledge	Assessment of the students' knowledge and skill levels, %					
	year 5			year 6		
	IT	FT	t-test	IT	FT	t-test
Knowledge of the algorithm for the initial examination of a critical patient	55.1 ± 1.4	97.3 ±3.1*	4,567*	85.3 ± 2.0	99.8 ± 0.6*	3,225*
Knowledge of the BLS algorithm	86.3± 2.4	92.5 ± 3.1	0,892	89.1 ± 3.8	98.3 ± 2.0	0,135
Ability to perform quality chest compression	88.1 ± 1.2	94.5 ± 1.0	0,765	89.5 ± 1.8	91.7 ± 1.2	0,274
Ability to restore the passage of the respiratory tract	32.9 ± 2.2	76.5 ± 2.2*	6,836*	55.4 ±2.1	77.6 ± 1.8*	3,493*
Ability to perform quality ventilation of the lungs	32.7 ± 2.2	76.3 ± 2.2*	6,458*	57.2 ±2.1	87.4 ± 1.8*	3,288*
Ability to operate an automatic external defibrillator	18.6 ±2.0	79.7 ± 2.4*	12,293*	64.6 ± 2.5	92.9 ± 2.5*	3,461*
Knowledge of the basic CPR algorithm	48.1 ± 2.4	82.3 ±3.1*	4,527*	76.5 ± 3.8	92.3 ± 2.0*	2,988*
Ability to operate a professional defibrillator-monitor	16.4 ±2.0	68.7 ± 2.4*	10,341*	58.6 ± 2.5	82.9 ±2.1*	4,517*
Ability to assess heart rate	38.4 ± 2.6	79.6 ± 2.2*	5,542*	54.5 ± 2.7	86.7 ±2.1*	4,025*
Ability to obtain intravenous or intraosseous access	17.4 ±2.0	62.7 ± 2.4*	6,931*	48.6 ± 2.5	82.9 ±2.1*	4,884*
Knowledge of basic medications used in CPR	78.5 ± 2.4	88.5 ± 2.2	0,688	85.6 ± 2.4	89.6 ± 2.0	0,214
Knowledge of potential causes of ineffective CPR	72.5 ± 2.2	89.3 ± 2.0	1,242	88.6 ± 2.4	90.6 ± 2.0*	0,562

Note: IT – initial testing; FT – final testing; * – probability of difference from the previous stage, $p < 0.05$.

In our view, these results are associated with reduced opportunities for senior-year students to gain practical skills in operation rooms and intensive care units, as has been pointed out by J.F. Crofts et al. (2007). However, the simulation training course enabled the 5th-year students to improve these practical skills.

Practical lessons with simulation training for practicing EMS skills were based on modern approaches to training and consisted of three sections. The first section of the class was devoted to the thorough theoretical study of the order of actions (algorithms) in performing manipulations. The second section of the practical class involved the direct practice of the skills on a mannequin or dummy under the teacher's guidance. The third and final section of the class consisted in summarizing the results of the lesson using the method of debriefing.

This algorithm of training was also utilized in a study by M.J. Shapiro et al. (2004), which shows that teamwork based on simulation training improves the work of the clinical team.

For successful mastery of the second part of the practical class, the training utilized a four-step method, which has been found effective in the training of nurses (Cant, Cooper, 2010) and surgical residents (Boyd et al., 2006). At the first stage, the teacher, according to the proposed scenario on the lesson topic, demonstrates the skills on a mannequin without explanations in real

time. Any commentary in this case will only distract and disrupt the demonstration. It is of principal importance that at this stage students see exactly the right way to perform the skills. Students may have questions immediately after the demonstration, but the discussion has to be postponed until the end of the next stage. At the second stage, the teacher demonstrates the skills again but slower, explaining each step. This approach gives students the chance to see the actions of the teacher once again, but this time with a detailed explanation, and ask their questions once the demonstration is complete. The third stage involves the teacher performing the skills one more time but upon the correct commands of students. Incorrect commands are ignored, which prompts students to analyze and search for the right solution. At this stage, students are actively involved in the work, having the opportunity to once again observe the algorithm of performance. The stage is completed with feedback with answers to questions and a quick summary and identification of key steps. Mistakes must be immediately corrected by the teacher. Failure to follow this rule can lead to the embedding of errors, which are then difficult to correct, in practical activities. At the final fourth stage, students demonstrate the performance of the practical skills independently on a mannequin and take on responsibility for the accuracy of their performance. After the fourth stage, each student must repeat the skills, which ensures the formation of EMS skills.

Thus the high precision of performance is achievable with the repeated demonstration of the practical skills by the teacher and their further repeated practice by students. The multi-step approach, as demonstrated by the results of training with simulators for laparoscopic suturing (Korndorffer et al., 2005) and emergency obstetric care (Crofts et al., 2007), allows mastering the difficult material, dividing it into simple components, and building a complex algorithm step by step. The skill is mastered in stages, from simple movements to independent complex performances.

The practical lesson was completed with a summary using the debriefing method, during which teachers together with their students analyzed their actions, highlighting not only the technique but various moments associated with communication and teamwork, the decision-making process, the role of the leader, the distribution of tasks, etc. The teachers and students together identified the successes and positive aspects and key problems and concluded what exactly has to be changed for the team to work better and more efficiently.

Thus, simulation training addresses a much wider range of tasks than the simple simulator-based practice of motor skills for specific manipulations and procedures. Of no smaller importance is the development of students' soft skills, specifically leadership and organizational qualities and the ability to make decisions and work in a team (Zairi et al., 2022). The constant increase in the quality requirements for the provision of EMS requires doctors and medical personnel to have not only a perfect theoretical basis but also a certain amount of practical experience. For this reason, the introduction of simulation training in Russian medical universities as one of the basic methods is a new direction in today's training of highly qualified top and middle-level medical personnel and a promising tool to improve the training of future medics through a combination of theoretical knowledge and practical skills, the development of a medical worker as a professional and an integrated person.

However, it's important to acknowledge some limitations of this study. While the study aimed to investigate the positive impact of simulation training on the level of training of medical professionals and the effectiveness of innovative technologies in developing practical skills, other potential effects or factors influencing the learning outcomes of participants have not been widely studied. The research primarily focused on specific aspects of simulation training and its direct impact on improving practical skills and knowledge acquisition.

5. Conclusion

The conclusions drawn from this study align closely with the objectives that were set out to examine the impact of simulation training on the level of training of medical specialists, particularly in the context of enhancing practical skills.

The results of the study demonstrate that different forms of simulation training (team lessons, joint drills, masterclasses) contribute to the assimilation of students' knowledge and practical first-aid skills and present a highly effective system of practical training. Medical team lessons are a priority form of training for practicing the algorithm of CPR. Joint training is utilized to practice organizational and practical skills in coordinating the activities of various services in emergencies. Masterclasses should be utilized as an element of practical training for large audiences.

The results indicate that simulation training significantly enhances students' ability to execute critical practical tasks and respond effectively to emergency medical situations. This empirical validation emphasizes the potential of simulation training as a pedagogical tool that not only bolsters theoretical knowledge but also cultivates the confidence and competence required to deliver efficient emergency medical services.

The theoretical significance of the study is provided by the identification of the potential of different forms of simulation training in the practice of higher medical education. The practical significance of the study is provided by the fact that its results can be used in organizing the training of students in emergency medical care. Prospective further research in this sphere may be the study of the readiness of medical university graduates to work in emergencies.

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Futurization of Education: Results of the Quasi-Experiment

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Abstract

The article is devoted to the study of the actual readiness of young students to separate themselves from individual experience and think about the future beyond personal needs. The most significant ideas of futurists about the mechanisms of thinking and shaping the future are analyzed. It is argued that the futurists, realizing the fundamental importance of educational activities, did not specify specific measures for the futurization of education. Empirically, the article is based on qualitative and quantitative methods. In the period from March 2022 to February 2023, a quasi-experiment, observation and interviews were conducted among Russian students. Theoretical and methodological analysis of the problem and the results of sociological research allowed the authors to develop ways to solve this problem based on individual and group work of students. Personal observations of the authors made it possible to assess the willingness of students to reflect on the future beyond personal experience and to identify possible obstacles to the educational strategy of futurization. The problem raised by the authors of the article actualizes the issue of accumulating experience in the field of future research, social forecasting, initiatives of international organizations, the development of original educational methods for integrating future issues into the education system.

Keywords: future, philosophy, education, higher education, futurization, futurization of education, futures literacy, future consciousness.

1. Introduction

The intensification of technical and technological innovations, the increase in the volume of information, the acceleration of the pace of social relations are the markers of our time. They were comprehended even in classical works on futures studies (Toffler, 1990a; Toffler, 1990b), (Fukuyama, 2003), etc. The understanding of modern trends has been consistently associated with a humanitarian problem, how to ensure the optimal human existence in conditions of abnormal rates of change? In fact, the futurists of the 20th century pointed out the humanitarian problem.

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Human's impotence in front of the future was conceptualized in terms of "future shock" (A. Toffler) and "future phobia" (I. Bestuzhev-Lada). These concepts denote the destructive reaction of a person to the changes taking place. Fear of radical changes, the destruction of the habitual way of life is systematically suppressed by "presentism" (I. Bestuzhev-Lada), that is, reflections on the future as an extended present.

The humanitarian problem is complicated by the special focus on new technologies. F. Fukuyama drew attention to this in the book "Our Posthuman Future". He claimed that the biology labs are symbols of modernity (Fukuyama, 2003). This means that technology not only reorganizes the world around a person, but also directly affects the person himself. Human has become projected, subject of design and programming (Callaghan, 2018). Transhumanism, for example, sees in a person a link to "posthuman", which is modified to such an extent that it will no longer be a person (Bostrom, 2003).

The key to solving the problem futurists saw and still see in education. This circumstance can be explained by several reasons: firstly, education is a channel for the exchange of experience between generations, and secondly, it is a socialization environment that provides a person with knowledge, skills, competencies for an optimal existence in the future. For a long time, they have been betting on education in solving the humanitarian problem. At the same time, education also needs to correspond to the time. According to A. Toffler, "The illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn and relearn" (Toffler, 1990a).

Futurists and forecasters have long been trying to move from theory to practice. For example, back in the '60s. R. Jungk called for the formation of special research groups ("prognostic cells") in all educational institutions and was convinced that at least a third of school and university classes would be devoted to future problems. Children will study the projects that have not yet been realized and discuss the books that have not yet been published. Fantastic literature will come out of the underground and take a worthy place on the shelves of school libraries.

Later, A. Toffler in "Future Shock" wrote about the need to create "councils of the future" in each school (Toffler, 1990a). According to the American futurist, the members of the councils should devote themselves entirely to studying the future in the interests of the present. The main activity of the councils will be reduced to designing variants of the prospective future. Moreover, the initiative groups should determine the educational trends corresponding to future versions.

Today, educational portals are developing, aimed at informing young people about trends. In particular, "Teach the Future" is a supporter of the reorientation of world education in the face of the climate and environmental crisis (Teach the Future). Noteworthy is Futures Day on the formation of futures literacy organized by UNESCO Chair (Unesco Chair..., 2020). Modern futurists are dealing with the problem of literacy concerning the future, developing a methodology for the formation of literacy. Futures literacy relies on a person's mental faculties to allow imagination. N. Larsen, K. Kæseler Mortensen, and R. Miller write that literacy concerning the future can be formed through the discipline of anticipation. It allows us to learn how to get to know the unfamiliar (Larsen, 2020). It all proves that the translation of scientific theory into educational practice is taking on broader forms. The problem of literacy concerning the future has come to the fore.

The contemporary education system in Russia does not have effective means to solve the humanitarian problem. This is represented in scientific research on the problem. Russian higher education became available to the masses in the 90s of the twentieth century (Bessudnov i dr., 2017). Despite this, a "crisis of higher education in Russia" is seen nowadays (Vakhitov, 2019). The main crisis feature of Russian education is the imbalance between market relations and the traditional, Soviet way of education. This way of education is characterized by rigid specialization, which is present in most educational programs.

Certain factors in Russian education interfere with the fulfillment of the request of futurization. First, in the education system, the list of disciplines about the future is reduced to planning in business, but excludes, for example, courses on bioethics and engineering ethics (Sawyer, 2006). Secondly, educational institutions function as "repeater amplifiers" (Pereslegin, 2004), which hinders the introduction of educational innovations and reduces the cognitive activity of students. Thirdly, in the conditions of capitalism people are not used to reflect on the prospects for the development of society and their contribution to the future of the social whole, but is guided by a particular interest and preoccupied with a personal future. As a result, the very possibility of students to distract from individual needs and to think about things that lie beyond personal experience is in question.

Russian philosopher A. Ursul argued that humanity should "include the mechanism of accelerated futurization of education" (Ursul, 2012a: 134). In essence, activation of the mechanism of futurization means a turn of the education system towards the future. In the interests of progressive development and the consonance of relations with the environment, education should be "ecologized" and "futurized". There is no doubt that education should have mechanisms that work to forestall destructive natural and social processes. The indicated idea raises questions about the method(s) of inclusion and the details of this mechanism. In the opinion of A. Ursul, it is necessary to pay close attention to the future "in all possible subjects and directions of the educational process" (Ursul, 2012a: 138). The problem again is to identify and take measures in achieving such attention. Unfortunately, nowadays these ideas are declared, not embodied.

The term "futurization" itself is not new. In particular, it was used in the context of psychiatry and denoted an excessive emphasis of thoughts on the possible and not the present (Pringuey, 2018). In 1970s. H.W. Eldredge used the term "futurization" (along with the synonym "futurism") in relation to university courses. The term meant the orientation of educational courses to inform students about current trends. The scholar noted that in the social and human sciences, "futurization", or "futurism", has not been realized to a large extent (Eldredge, 1975).

In this article, by "futurization" we mean a strategy focused on integrating the problems of the future into the system of education, as well as the humanitarian response of participants in the educational process to technical, technological, political, and other trends.

In the book "Revolutionary Wealth", A. Toffler mentioned that education system is conservative in the questions of the future. According to the futurist, the 'machine' of education is traveling slowly, preventing the movement of progressive social institutions. A. Toffler and other futurists agree that the current system of education does not correspond to the time (Grady, 2003: 67). In this case, the problem lies not only in the conservatism of educational policy but also in the search for means of checking the level of cognitive activity of students. In other words, futurists and educators should think about how to check the student's readiness to talk about the future. In the context of this study, the question can be reformulated: by what means can be determined students' readiness to distract from individual experience and to reflect on things that lie beyond this experience.

In our research, we were faced with the fact that most of the Russian students are not informed about technical and technological trends, hi-hume, and transhumanism. Using the terminology of S. Ahvenharju, we can say that a "sense of contemporary trends and challenges" is under question (Ahvenharju, 2018). Without this "sense" (despite the fact that this is only one of the factors identified by the scholars), an effective solution to the humanitarian problem is hardly possible.

Complicating the situation is that students focus on gaining knowledge in their specialty. We assumed that there is a gap between the intensification of technological development and student ignorance. In this regard, we formulated the main research question: how is it possible to bridge the gap between objective conditions (technical and technological progress) and the level of awareness of students about high technologies? Research hypothesis: one of the possible reasons for this gap lies in the orientation of the thinking of Russian students. The research purpose: to reveal meaningfully the peculiarities of thinking of Russian students that hinder the futurization of education.

2. Theoretical Framework and Methodology

2.1. Theoretical Framework

A. Ursul presents the conceptual foundations of the futurization of education in his papers. The philosopher gives the definition of futurization, which we took as a basis. He defined futurization as a strategy of advanced education with an orientation of the educational process towards a sustainable future (Ursul, 2012b: 20). Thus, futurization has a global goal: the prevention of global disasters (for example, environmental) through proactive decisions. Advanced decisions require advanced consciousness (Ursul, Ursul, 2014: 34). In Russian studies, the term "futurization" has been worked out only in the most general terms. In A. Ursul's works, there are no indications of the mechanisms for the implementation of futurization in education, which raises the problem of implementing this strategy. On a theoretical level, the existing conceptualization is insufficient. That is why we use G. Biesta's "subjectification" as the conceptual foundations of futurization. The scholar formulated the premise that the student should be the subject of his life, the source of his own decisions, and not the object of educational technologies and methodological intervention. First of all, subjectification is associated with the freedom to

think and act. At the same time, freedom of thought and action is impossible without responsibility (Biesta, 2020). Learning and teaching to think and act "like an adult" is the ultimate goal of futurization as an educational strategy.

The practice of futurization of education refers to first-order changes in education, according to the classification of D. Mireille and Dr. Hubers, since it has not yet received state support and has not been implemented in specific educational institutions (Hubers, 2020). The future is interesting for students (stages of the experiment clearly demonstrated this). However, the prevailing "prescriptive" education system does not always allow satisfying students' interest. Futurization is ideologically connected with the transformative concept of education, focused on the integrity of a person, on the personality of the student (Biesta, Miedema, 2002). In particular, futurization is aimed at adapting youth to developing social trends, which is necessary for optimal existence in society. At the implementation of futurization (Stage 2), critical thinking should be formed as one of the key meta-competencies of education for the future (in particular, the futurological game is directed towards the formation of critical thinking) (Rieckmann, 2012).

For education to rise to a qualitatively new level, a culture of forecasting is included, or, in terms of P. Hayward et al., "Generic Foresight Process" (Hayward et al., 2012), where futures literacy is required. Futurization serves to form this primary literacy and therefore includes, for example, intellectual games, systematic appeals to science fiction as forms of culture familiar from childhood.

The fundamental importance of the experiment can be expressed in terms of the relational concept (Ahlqvist, Uotila, 2020), or the concept of "weak signals". At the beginning of the experiment, we were faced with the fact that the presence of an observer and an object does not guarantee the formation of meaning, the vision of the development prospects of the object, the ability to measure a specific phenomenon and understand its context.

2.2. Methods

The methodology of the study corresponds to the general logic of the educational quasi-experiment, taking into account a number of limitations of the study: we used convenience sampling; there is no control group and an assessment of the statistical reliability of the effects obtained in the study.

Stage 1 took place in the first half of 2022 (March-May), stage 2 – in the first half of 2023 (January-February). The main goal of Stage 1 was to establish the level of readiness of Russian students to speak competently about the future (in particular, awareness of technical and technological trends); Stage 2 includes pedagogical forms that are non-traditional for Russian education, attuning students to the problems of the future, film seminars and intellectual games. Film seminars involved the analysis of audiovisual materials. Students had to correlate the content of the film with real-life trends, assess the degree of realism of science fiction movies. The second form involved a futurological game. Students had to imagine that a certain fantastic "artifact" became part of everyday life; students had to describe the possible economic, political, cultural level of society that has this "artifact".

Stage 1 included two sub-stages. In Stage 1.1 we used a survey, in Stage 1.2 we conducted interviews. The respondents were 1-4 year students (bachelor's degree) of South Ural State University (Chelyabinsk, Russia). In total, students from 9 educational programs (medicine, biology, computer sciences, mechanics, robotics, linguistics, history, psychology, etc.) took part in the survey.

The total number of survey participants is 1,000. We used convenience sampling.

The survey questionnaire included 4 open-ended questions. The questions were aimed at identifying the level of awareness of students about hi-hume – technologies that affect human nature (body, cognitive abilities, psycho-emotional state, etc.):

I. What modern technologies (including those that are being developed, not yet applied in practice) associated with interference in human nature are known to you?

II. What are some examples of the progressive impact of hi-hume technology on human nature? Justify your position.

III. What are some examples of the regressive impact of hi-hume technology on human nature?

Justify your position.

In the last question, two quotes were presented. The respondent's task was to choose the one that corresponds to their own worldview position and to justify their choice. Students were offered statements that were opposite in content:

IV. Read two quotes. Do you agree with the content of the abstracts? Try to express your own opinion on the topic to which these statements are devoted. The first quote: "Human is the peak of the evolution of the universe" (G. Andronov). The second quote: "... the human species is not the end of our evolution, but rather its beginning ... We can use not only reasonable ways to improve the position of human and the world around him; we can also use them to improve ourselves, the human body" (N. Bostrom).

In the process of modeling the research, we put forward a hypothesis: the receiving education, its specialization (direction of study), directly affects the respondents' ideas about the future (Tables 1, 2).

Table 1. Educational specialties

Specialty of respondents	Number of respondents
Automation of technological processes	93
Design of Architectural Environment	68
Journalism	86
Communication systems	100
Computer engineering	96
History	74
Clinical psychology	66
Design and technological support of machine-building industries	108
Linguistics	80
Materials Science	94
Mechatronics and Robotics	84
Teacher Education	51

Table 2. Distribution of respondents by year of study

Number of respondents	Year of Study
189	1
278	2
297	3
236	4

For the second substage, interviewing, two people from each specialization were chosen (in total – 24 students). The choosing of respondents was based on the results of a survey. In each group (the groups were formed in accordance with specialties of students), 1 respondent was selected who did not substantively answer any question and 1 respondent who detailed the content of the answer to each question of the questionnaire. The interview consisted of 3 questions, following the logic from a concrete subject to a large-scale and abstract, from simple to complex:

I. What will you do tomorrow?
II. What will be your usual day in 2049?
III. How do you represent our country in 2049?

The interviews were conducted in public, with participating observers (students studying in the same specialty). After the participants gave answers to 3 questions, it was a public discussion of those answers.

As part of Stage 2, pedagogical forms that are non-traditional for Russian education were introduced into the educational process, attuning students to the problems of the future, film seminars, and intellectual games. The main goal of this stage was to assess how students comprehend the problems of the future on the example of a specific topic. The participants in Stage 2 of the experiment were divided into 12 groups according to the number of specialties. At Stage 1 students relied exclusively on existing knowledge; at Stage 2 students were offered material for thought. Each of the 12 groups was divided into 3 working subgroups. Students were to watch 3 films: "A visitor to a Museum" (1989, Konstantin Lopushansky), "Dead Man's Letters" (1986, Konstantin Lopushansky), and "The Road" (2009, John Hillcoat). All films are united by the topic of ecological disaster. After viewing, the task of the students was to identify and record a list of

factors that contributed to the environmental disaster. The list was not limited to a given framework. Participants could freely capture both natural and anthropogenic factors if they took place in a particular film. As authors of the experiment, we evaluated the number of these factors, the correctness of the wording, as well as the correspondence of each specified factor to the content of the film.

The futurological game was carried out in the form of a thought experiment. The work was also with the same 12 groups. The participants were asked to imagine how the social conditions and life of each individual would change with the introduction of a hypothetical technical innovation, to assess the likely progressive and regressive consequences of the spread of a fantastic invention. The "teleport" was taken as a fantastic artifact. The participants were shown a visual series with images of the teleport. The preliminary stage of the experiment: the participants had to name and identify the artifact, focusing on the visual series. Each group had to identify and fix the options for the influence of the hypothetical artifact on various spheres of society (politics, economy, social sphere, culture). The correctness of the wording was assessed, as well as the range of the indicated options of influence.

3. Results and Discussion

3.1. Stage 1. Diagnosing students' futures literacy

3.1.1. Survey

As a result of the survey we received a wide range of technologies related to the interference in human nature. The list included prosthetics, human microchip implant, creation of augmented and virtual reality, synthesis of software with the brain, laser surgery, brain stimulation, organ transplantation, artificial insemination, incubation of premature infants, interference with the genome, use of pharmaceuticals, use of emotion detectors, neuro-linguistic programming, cloning of organs, cryonics, reading of brain, treatment of mental disorders, destruction of viruses, biorobotics, management of climatic terms. Along with the list of technologies related to interference with human nature, an alternative list was drawn up. Students did not always answer the question posed and replaced the concept of technology with the concepts of instrument hardware (technical artifact), science, or knowledge. According to the students, technologies include cybernetics, surgery, and neuromathematics (fields of knowledge and discipline), as well as artificial intelligence, smart houses, armament, sinusoidal harmonic oscillators, televisions, computer games, tablet computers, headphones, Oculus Rift, Google Glass, 3D printers, electrocardiographs, antibiotics, anesthesia breathing apparatus, drugs, exoskeletons and truth serum (artifacts).

None of the students named more than four technologies related to the interference in human nature. Some students identified more than four positions; however, they made mistakes and pointed out artifacts and areas of knowledge instead of technologies. Less than a quarter of the total number of students was able to name three or four technologies. The relative majority of students could name one or two technologies. Almost a third of the total number of students could not name any technology. These included those who identified artifacts or areas of knowledge (Oculus Rift, cybernetics, etc.) (Table 3).

The results of the first part of the research show relatively low awareness of young people about new human-oriented technologies. We assume that the reasons for this situation are related to the cognitive activity of the individual and the functioning of the education system. Specialization can impede the formation of general scientific literacy. In the Russian education system, there are practically no disciplines devoted to the problems of the future and suggesting the study of "megatrends" (John Naisbitt) and "microtrends" (Mark Penn). It turns out that students themselves must study actual technical, technological, humanitarian, and other tendencies.

Table 3. Results of the survey. Number of trends indicated

Number of named trends	5 and more	3-4	1-2	0
Percentage of the total number of respondents	–	22,4	44,8	32,8

The overwhelming majority of students were able to name one or two technologies and briefly substantiate the choice. Among the interviewed students were those who could name more

than two technologies, but did not want (or could not) think over the possible consequences of their implementation. About a third of respondents could not indicate any progressive consequences of the introduction of any new technology. Obviously, the consequences of introducing human-oriented technologies do not lie on the surface. Few are ready to express their own opinion, suggesting a preliminary critical assessment of the subject (Table 4).

Table 4. Results of the survey. Assessment of progressive and regressive consequences of technology introduction

Consequences of the introduction of new technologies	Progressive			Regressive		
	3 and more	1-2	0	3 and more	1-2	0
Percentage of the total number of respondents	6,9	60,3	32,8	–	51,7	48,3

The final question of the questionnaire implied agreement with one of the opposing judgments and a brief justification of the opinion. It is noteworthy that most students agreed with the second judgment (Table 5):

Table 5. Results of the survey. Agreement with one of the opposing judgments and a brief justification of the opinion

Position of the respondent	Percentage of the total number of respondents
Agree with the first judgment (without justification)	1,7
Agree with the second judgment (without justification)	5,2
Agree with the first judgment (with justification)	6,9
Agree with the second judgment (with justification)	74,1
Agree with both judgments (with justification)	1,7
Agree with both judgments (without justification)	–
Disagree with any judgment (with justification)	3,4
Disagree with any judgment (without justification)	1,7
Missed the question	3,4

The list of arguments in defense of the second position, in general, is quite wide: mankind will fight against diseases and aging; the world is constantly changing and the evolution of human is inevitable; new technologies that can change a person will develop; a person needs adaptation to environmental conditions; technologies cause a change in human life; a person has always aspired and will strive for a better life; evolution will never end; a person must overcome the flaws of his nature and, in particular, the animal's beginning (instincts); a person has not yet fully understood the world around him; only death can stop the development of the species; science is constantly evolving and creating something new.

All arguments can be divided into two groups: "subject-centered" and "logo-centered". According to the judgments of the first group, a person is a source of changes in the world around him. This group includes statements about the fight against diseases and aging, adaptation to new conditions of life, the desire for knowledge, and the struggle with the animal origin. According to the judgments of the second group, certain conditions (laws of nature, evolution, science, and technology, etc.) force a person to change. The second group included judgments about the irreversibility of evolution, the progressive development of science and technology. In substantiating their position, respondents did not use dialectical logic, which could allow them to see the contradictory nature of the development of a particular thing.

The statement about the inevitability of evolutionary processes belonged to a Swedish-born philosopher, transhumanist Nick Bostrom. Transhumanists call for victory over the "blind" evolution and the construction of human nature. A person can and must change. New technologies (including hypothetical ones) will be assistants in the matter of revolutionizing the nature of Homo Sapiens. The popularity of Bostrom's idea, of course, is not the key to the popularity of H+ in the student environment. Many students interpreted this idea in the context of logo-centrism. In other words, they do not believe that evolution is an objective planetary process. Nature is not interested in the desires and aspirations of the individual. The individual, in his turn, cannot change anything. Fatalistic ideas are strong in the student environment. Often we had to answer "rhetorical" questions like: "Why talk about the future if it does not exist?"; "Don't you think that the future will not ask us anything?"; "Do you think that we will be able to change something?"

3.1.2. Interviewing

The second substage was interviewing. In 12 groups 2 participants were asked 3 questions about their day in the present (1st question), their day in the future, 30 years from now (2nd question), a situation in the state in the future (3rd question).

The answers to the first question were detailed, the students described in particularities their "tomorrow". The audience learned about the daily routine, work, study, personal preferences of the interviewee, etc. The answer to the second question required reflection. The students tried to imagine themselves as elderly people. They assumed that they already have grandchildren. They said that they would work less and devote more time to everyday life. In general, the daily routine in 2049 was not fundamentally different from the daily routine in 2019. For example, one of the respondents suggested that the technique would greatly facilitate his housework.

The third question puzzled the respondents. In particular, this is due to the scale of the subject. Not every expert can describe even the current situation in Russia, without talking of the future. To facilitate the situation of the respondents, we suggested that they reflect on the future state of various spheres of society. Students were attracted especially by the social sphere, art, and culture.

There were a lot of comments on the third question and no comments on the first and second questions. This is due, firstly, to the comparative completeness of the information. The interviewees described in detail the schedule of their tomorrow. Secondly, personal life is not interesting in comparison to the public sphere (Bernstein, 2015). The future of the state, on the contrary, directly or indirectly affects the entire audience.

The answers expressed the presentism of the interviewees' thinking. For example, respondents suggested that the political situation in Russia would not actually change. Against the backdrop of presentism judgments, at first glance, judgments about artificial intelligence were distinguished: a machine capable of solving all the most complicated problems will control humanity. In practice, this statement does not go beyond the limits of collective experience. In science fiction, the topic of artificial intelligence was popular in the '60s and '70s of the last century. Over the past two decades, interest in this topic has been fueled by cinematography (Matrix, I, Robot, Her, Electric Dreams, etc.). As a rule, the films show the circumstances of the catastrophe caused by the loss of control over artificial intelligence. Fantastic literature and sci-fi cinema can be assessed as a response to civilizational challenges and technological megatrends. Culture responds to the pathos of rationalism, preoccupied with the structure of the world on a reasonable basis.

Students argued about the future state of Russia and easily expressed categorical judgments. For example, it was claimed that culture would degrade. The opposite view was based on the belief in cultural pluralism. Along with new and unknown forms of culture, traditional genres (opera, operetta, etc.) would be also preserved. The interviewing showed that the formation of the so-called "Time Perspective" and, in particular, long-term thinking is in question. Meanwhile, for "future consciousness", it is hardly enough to roughly imagine how tomorrow will turn out (Ahvenharju, 2018: 9). In addition, in an interview with 24 students, 18 expressed identical judgments: it makes no sense to think about the future in the long term, because the future is not definable. To the clarifying question, why is it "not definable", 15 out of 18 students answered: "Because it is not we who do it, but those who have the power". Three respondents did not substantiate their claim. In this case, it is appropriate to recall that future consciousness includes a sense of how the future will unfold and how it can be influenced (a sense of being able to influence how the future will unfold). This is described in more detail in S. Ahvenharju's paper (Ahvenharju, 2018: 9).

The comparatively large number of comments on the third question is a significant indicator. A person can freely talk about the future of the state and make the boldest assumptions about it. First, it was about the state as a whole. Secondly, the answer to the third question had an indeterminate number of voids. The observers unsuccessfully tried to fill these voids with their comments. One of the fundamentally important results of the application of this method was to exchange views. Obviously, in the situation of the polylogue, it is difficult to come to strictly defined conclusions. However, pluralism of points of view is directly related to the space for thought, promotes a multifaceted study of the subject, and stimulates critical thinking.

3.2. Stage 2. Non-traditional pedagogical forms

Film seminars

The practice of film seminars proved its worth. One of the series of film seminars was devoted to environmental issues. We especially wanted to avoid the repetition of ideas expressed by environmentalists, participants of the Club of Rome, etc. We also refrained from the slogans of environmental organizations and political parties. We tried to approach the solution of environmental problems with the help of cinematography (the so-called post-apocalyptic anti-utopias) because of its distinctively cinematic interest and the philosophy of existentialism.

After watching the films and reading the fragments of the philosophical book related to the topic, the overwhelming majority of the participants were able to name 1 or 2 factors of an ecological disaster. 96 % of the responses contain indications of the same factors: nuclear war and depletion of natural resources. In the remaining 4 % of answers, these factors are clarified and meaningfully disclosed: depletion of the ozone layer, “nuclear winter”, gas pollution, pollution of water sources, irrational organization of industrial enterprises. Only six answers indicated an indirect factor, the specificity of a person's thinking, consumer orientation. Apparently, this is due to the study of the course of general philosophy and, in particular, the texts of M. Heidegger. All participants who named 1 or 2 factors did not reveal them meaningfully (Table 6). This is probably due to the fact that students are not informed about “nuclear winter” and other factors associated with a nuclear catastrophe. In any case, this requires additional research in the future.

Table 6. Factors of ecological catastrophe identified by students after watching films

Film	The number of recorded factors of environmental disaster	Percentage of total students
“A visitor to a Museum”	0	34
	1-2	57
	3 or more	9
“Dead Man's Letters”	0	12
	1-2	76
	3 or more	12
“The Road”	0	15
	1-2	74
	3 or more	11

Ultimately, the seminars were aimed at introducing students to one of the most important means of changing the ecological situation, that is, to reflect on their own life project. This is closely related to the “subjectification” of G. Biesta. Based on the results of this part of the experiment, several assumptions can be made that require future verification: 1. It is possible that students have poorly formed ability to analyze. 2. Students are not informed about the advances in forecasting (in particular, about modeling “nuclear winter”). 3. Finally, the lack of awareness about ecology can be a significant obstacle for students to form their own worldview position.

Futurological game

Unlike many other educational forms, the intellectual game allows us to draw the attention of youth to discussions about the future and to cause their genuine interest to serious questions. The use of games in forecasting and education is a topic of numerous serious scientific researches. The game can be part of prognostic procedures (Cesa-Bianchi, 2006: 301-310), an element of data mining (Koedinger et al., 2015), teach the basics of the scientific picture of the world (Clark,

Martinez-Garza, 2012), motivate learning and improve academic performance (Hwang et al., 2015; Yang, 2012). An integral part of game-based learning can also be learning the basics of forecasting using the game. In the game, we presented the basics of modeling, a systematic approach, and extrapolation in forecasting. These methods have been reproduced exclusively at the training level.

The progress of the groups was determined by the rules of the futurological game "Archeology of Time" (Segal, 2017: 785). The meaning of the heuristic game is reduced to constructing the image of a society of the future, using (or not using) the artifact from the future. The archaeologist deals with an artifact lying in a certain cultural layer. Based on the data on the find, the scientist tries to reconstruct the past. The "archaeologist of the future" deals with the image of a hypothetical object (tool or technology) and imagines how society will develop.

The task of one group of participants was to justify the high importance of the artifact from the future and, consequently, to prove that the object will necessarily appear. The task of the other group was the opposite. As part of this research, the subject of the future was a teleport. Participants had to name and identify the object (footages from The Fly, Jumper, Contact, etc.). Defining the artifact of the future, the students had to formulate arguments. The search for arguments was the most difficult task and required at least some logical tools, abilities for analysis and generalization. The content of the next stage was to formulate questions for opponents. At this stage, it was necessary to find lacunae in the arguments of rivals and correctly formulate a question that allows achieving the predicament of opponents.

Pluralism of opinions arose already in the first stage of group work. The participants gave five variants to name the artifact: television camera, Tardis (machine from the series "Doctor Who"), time machine, teleport, and portal. Supporters of teleport were divided into two "camps". Some have defined a teleport as "a device and (or) an object that instantly moves an object in time and (or) in space, contributing to the entry of this object into alternative worlds". Others have defined the teleport as "a device and (or) an object that instantly moves an object of reality in time and (or) space". These definitions are comparable and have many similarities. However, most participants decided not to focus on the near-scientific theme of travel to parallel worlds. The participants did not pay attention to the fact that they contrast the concepts of the device and the object. As the "obvious" was the statement about the instantaneous displacement. Supporters of the portal defined it as "a gap in space and (or) the time through which you can move". The statement about the instantaneous displacement was discarded.

Supporters of teleport won with a relatively small margin. It is noteworthy that the invention was conceived as an unconditionally significant scientific discovery and breakthrough in the field of scientific knowledge. Supporters argued that the teleport poses no danger to the environment. On the contrary, the players decided that with the help of this device it will be possible to get rid of waste (including radioactive waste). Unfortunately, the issue of the final point of the "garbage journey" remained unanswered. A special group of judgments concerned the universal consequences of the appearance of teleport (portal). The optimism of the argumentation was reduced to the embodiment of the dream of cosmic thinkers, that is, to the possibility of free travel around the galaxy and going beyond it. Pessimists argued that the device will give rise to chaos and cause the destruction of the universe.

Reasoning about the importance of the artifact for the economy has been reduced to several statements. Some arguments can be presented as opposites: the device will save resources and significantly reduce transportation costs/operation of the device will require a large expenditure of energy; positive transformations of the social environment (for example, the development of the education system)/negative transformations of the social environment (the growth of crime). The same was for the arguments about the impact of teleportation on a person: safety for health/danger to health; personal growth/degradation of a person's spiritual culture.

The study of opposites made it possible to understand better the purpose of the task, to evaluate the potential innovation in a multifaceted manner, and to recognize that the introduction of any significant innovation has both positive features and pitfalls. A couple of arguments illustrate this trivial thesis. Supporters of innovation argued that teleportation in time will correct mistakes of the past. Opponents, in turn, focused on the importance of self-development and learning from their own mistakes. In other words, it is important not only to correct mistakes but also to learn to live with them. The problematic place of the game is the application of a systematic approach by students. It requires taking into account numerous factors, relationships of the object with simulated conditions. As a rule, students need to learn to see the

context of technological innovation and to assess the complex of relations of the object with the spheres of society (politics, economy, culture).

4. Conclusion

In our study, we focused on identifying, firstly, the level of awareness of students about technical and technological trends, secondly, the degree of correctness of reasoning about the future outside the individual life (personal plans) of students, thirdly, the formation of the ability to analysis, fourthly, the ability to take into account the positive and negative aspects of certain trends, tendencies, processes. For this, as we assumed, it is necessary to overcome the one-dimensional thinking about the future.

At the same time, the one-dimensional thinking about the future is constituted by the factors identified in both stages of experimental work: 1. Lack of awareness of trends. The reasons for this situation can be both the student's disinterest (subjective factor) and the orientation of Russian education towards narrow specializations, profile (objective factor). Another factor may be the transmission of outdated information in the educational environment. In any case, these assumptions require argumentation and further research. The results of the survey showed that students are relatively poorly aware of hi-hume technologies 2. Unwillingness to go beyond the boundaries of personal experience. The interviews showed that it is difficult for students to talk about things that directly lie outside the boundaries of their personal experience. The Russian futurist I.V. Bestuzhev-Lada wrote about psychological barriers preventing the imagination of a qualitatively different, in comparison with the present, future. He called this phenomenon "presentism" (Bestuzhev-Lada, 1990: 74). "Presentism" is expressed in the fact that people think of the future as an extended present. 3. Lack of analytical skills. The film seminars revealed difficulties in analytical work. It was probably difficult for the students to see the "details" of the subject of analysis. This is confirmed by the small number of identified factors that were contributed to the environmental disaster. 4. Difficulties in determining and evaluating the various aspects of the subject, the possible positive and negative impact of the subject, phenomenon, process on a person, social relations, culture, etc.

The problem that the students are not yet ready to speak about the future is hampered by the habitual way of life of a person, the "presentism" of thinking, and the standardization of the content of academic disciplines. As a result, a person feels "impotence" before the future (Yakovenko, 2016). A person cares little about what does not enter his personal space. Nothing is surprising in that the student is concerned about his own needs and personal future. The futurization of the current education system in Russia is still limited to a few economic disciplines ("Organization and Production Planning", "Forecasting and Planning in Service", etc.) and technical disciplines ("Basics of designing electronic devices", "Computer-aided design systems", etc.). The results of the research turned out to be contradictory: on the one hand, it became clear that serious talk about the future in the classroom could not yet take place; on the other hand, without the use of specific techniques, it cannot take place.

Within the framework of Russian education, it is possible to assess the willingness of students to abstract from personal needs and thinking about things that lay outside of individual experience with the help of competently used educational strategies. These educational strategies ultimately boil down to encourage individual and collective work on the identified problems.

Nowadays a serious attitude to the political, economic, social, spiritual, environmental, and other problems that directly affect the existence and development of the social whole is required from a person. One of the objective reasons hindering this attitude is the dominance of futuropluralism, that is, the set of projects and models of the future. It is not easy to find your bearings in the "labyrinth of prophecies". This requires critical thinking, a comprehensive assessment of the subject, and, ultimately, a person's desire to go beyond personal needs and an individual life project.

To overcome the gap between objective conditions (technical and technological progress) and the lack of awareness of students about high technologies, Russian education needs a comprehensive strategy, the futurization of education. The practice of futurization is not limited by the framework of any special course. The subject of such a course would be extremely broad and blurred. The effective application of the strategy of futurization is to study the different facets of the future. Consequently, lectures of all profiles, natural science, technical, social, and humanitarian disciplines should contribute

to the practice of futurization. Only in this state of affairs, a comprehensive examination of the subject and the rejection of a narrow-profile orientation are possible.

Today there are no futurization mechanisms in Russian education. Meanwhile, it is necessary to transfer futurization from theory to practice, a real initiative of researchers and educators. Futurization can be effective only by taking into account the accumulated experience in the fields of futures studies, social forecasting, the initiatives of international organizations, as well as scholars who have developed original educational methods for integrating future issues into the education system.

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The Study on the Connection between Motivation for High-Performance Learning and the Level of Academic Performance among Students of Various Levels and Areas of Study

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Abstract

Developing the potential of young adults is impossible without education, including higher education. Opinions vary on how grades affect further success or failure of an individual, however, educational results are first and foremost evaluated by academic performance, which depends on many factors. Some of them can be influenced by professors and other university staff, as well as parents, schools and other professionals, such as career counselors. One of the deepest and most important issues to study is student motivation.

The objective of this work was to study the connection between motivation for high-performing studies and the level of academic performance among students of various levels and areas of study at the Financial University. The research was conducted through a sociological online survey of a wide sample of students at the University. The survey enrolled 1324 students of all years, faculties, full-time and part-time forms of education.

This article presents the results of a three-stage study: the first stage was related to researching the characteristics of academic performance among students, the second stage was focused on the connection between motivation for high-performance learning and the level of academic performance among students at various levels of education (undergraduate/graduate). Finally, at the third stage, we studied the connection between motivation for high-performing learning and the level of academic performance among students of various faculties.

The results showed that the higher the progress of students is, the more their intrinsic motivation prevails, and vice versa, students with low progress incline to extrinsic motivation and amotivation. The practical significance of the results obtained is that they can be used for creating various programs of additional extracurricular activity in universities, for career guidance for school students and higher school applicants, and for consultations, including admission consultations with young adults and their parents.

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1. Introduction

Developing the potential of young adults in higher educational institutions is inextricably connected with the educational process, since the main goal of studying in higher educational organizations is to acquire a profession and related competencies obtained in the course of studying the disciplines that are settled in the curriculum for a particular special field. Academic performance, meaning the grades that students receive for their tests and exams, may indicate the level of their intellectual potential, as well as their professional and social skills. In this regard, it seems relevant to study the factors that affect academic performance, especially such internal factors as motivation.

Academic performance is one of the most important aspects associated with the learning process at universities. Various scientists have studied a fairly large number of factors that may be linked with academic performance or may affect academic performance: relationships with teachers (Ruiz-Alfonso, Leon, 2017; Vallerand et al., 1992), student relationships with each other (Ingraham et al., 2018), mental well-being (Shen et al., 2010). Psychologists have recently joined such studies (Alessandri et al., 2020; Bean, Eaton, 2012).

The researchers from this field were interested in the factors that can be related to academic performance. In particular, the researchers from Romania assessed how student performance can be related to their involvement in the learning process and the burnout they may experience (Paloş et al., 2019).

By burnout, in this case, the researchers meant a personal state characterized by a shift in attitude to the educational process as a whole, to fellow students, to teachers, etc. Students who experience this state quite often feel disappointed in their profession, in the learning process, in the university that gives them the opportunity to get a profession, etc. Therefore, as some researchers note, it is important not only to help students who experience such a condition but to prevent it, help reduce the conditions that may lead to burnouts. Researchers focused on burnouts have repeatedly noted that among the professions most prone to it, the "risk group" consists primarily of those whose work throughout their whole professional career is associated with communicating and interacting with other people (Pronin et al., 2020).

What other emotional states can be associated with burnout? Researchers quite often state that stress can directly affect the level of academic performance among students. For example, scientists from Ghana studied the influence of stress on academic performance at medical colleges. For that purpose, they asked students to complete a stress study scale. Besides, they assessed student grades and the methods they most frequently use to protect themselves from stress. The researchers proposed to divide stress into several main types, in accordance with the events that can cause it (so called stressors):

1. Academic stressors (i.e. events related to studies and the duration of vacations).
2. Interpersonal stressors (i.e. events linked to intragroup relations, obligations towards relatives).
3. Intrapersonal stressors (bills to be paid and situations when students spend more money than they can afford).
4. Environment-related stressors.

Statistical processing showed the following results: there is a difference between students who use various methods related to stress management. It was also found that the way students react to a stressful situation has a significant impact on their academic performance. After additional statistical data processing, it was also stated that the amount of vacation time (if not enough) also affects student academic performance. All these factors play a rather important role in the process of successful learning and efficient understanding of lessons (Hayford et al., 2019).

Researchers also pay a rather high attention to situations when a student cannot cope with the academic load at the university. In particular, the models based on the data obtained from the learning management system (LMS) at the University (Australia), made it possible to predict with fairly high level of probability which students might have difficulties in studying in an educational institution. Two main factors were used to build these models:

1) admission to the university (for example, entrance exams or practical work experience);
2) class attendance (for example, full day or private attendance).

The undoubted advantage of these studies may be in the fact that the use of these models can be one of the preventive, but quite effective measures for timely assistance to students (Helal et al., 2018).

The results of various studies confirm an interesting pattern: the level of academic performance is influenced by various factors that are connected, among other things, with the student education area (or, in other words, with the faculty they study at). In particular, the study (Ingraham et al., 2018) shows that there is a relationship between the student learning area and the success in learning that they demonstrate. So, the researchers come to the conclusion that this process is influenced by a limited number of factors. In particular, they include: support from teachers, care and concern for students, diversity (for example, in teaching methods) and ignorance that can be shown from both teachers' and students' sides.

Some researchers paid attention to other psychological aspects that may be important indicators of student academic performance. Quite often in the university environment, complaints can be heard (in particular, from mathematics professors) about low motivation in students. One of the researches specified that internal motivation and interest from both students and teachers has a positive effect on the academic certification of mathematical course participants (Ruiz-Alfonso, Leon, 2017).

Thus, academic performance of university students is determined by various factors (Kavousipour et al., 2015), many of which have been previously studied by researchers from various countries. However, a large-scale study of the connection between academic motivation and performance of students from a financial and economic university, broken down by year groups, faculties and levels of education, has not been previously conducted. This study is intended to eliminate this gap in scientific knowledge, and its results can be used for organizing extracurricular and educational student activity in order to influence their motivation type and, thereby, improve learning results.

2. Materials and methods

The objective of this empirical study was to explore the specifics of student academic performance, its dependence on various factors, both organizational, related to the students' place of residence and work, and motivational. To do so, their academic performance and a number of other factors that may also affect their academic performance were assessed. In particular, these include:

1. The student's place of study (for example, whether he studies in the same city he graduated from school or moved to another region.
2. Job (if a student works, does it somehow affect his/her academic motivation).
3. Job area, that is, whether their job is related to their major.

To explore the specifics of academic performance, students were offered to answer a range of questions (Table 1).

Table 1. Questions Offered to Respondents

Question	Answer Options
How would you evaluate your performance at the university in general?	1. high (I am at the top 25 % at my year) 2. above average 3. average 4. below average 5. low (I am at the 25 % of the least successful students)
How would you evaluate your chances to successfully graduate and get a diploma?	(0-100 %)
In your opinion, what are your chances to successfully (with no fails) pass your term exams?	(0-100 %)
You study:	1. in the same city you went to school 2. another city but the same region you went to school 3. moved to study to another region 4. moved to study to another country

Do you have a job?	○ yes, regular job (full-time) ○ yes, regular job (part-time) ○ yes, regular job (flextime, freelance) ○ occasionally (project work etc.), not regularly ○ no, I don't have a job
If you have a job, can you say that it is in the same area you study at the university?	1) yes, the same 2) mostly yes (has a certain connection with my future profession) 3) mostly no (remote connection to my future profession) 4) no, not connected

The next stage of the research implied a study of the connection between motivation for high-performance studies and the level of academic performance among students at various levels. For these purposes, their academic performance and motivation for high-performance studies were assessed. The research methodology was based on the Academic Motivation Scale questionnaire (Osin i dr., 2014). This methodology, designed to measure the level and type of motivation for learning activities, was created by T.O. Gordeeva, O.A. Sychev and E.N. Osin in 2014 based on the Academic Motivation Scale by R. Vallerand (Vallerand et al., 1992) and is represented in the form of a questionnaire with statements grouped by 7 main factors that determine student motivation for learning, 3 of them related to internal motivation, 3 to external and 1 to absence of motivation:

1. Learning motivation – includes statements related to collecting new information. Example of statement: "It is interesting for me to learn".

2. Achievement motivation – contains statements related to solving problems and getting satisfaction from the process. Example of statement: "Learning gives me pleasure, I like to solve difficult problems".

3. Self-development motivation – statements in this block were related to considering learning as an internal process of self-development. Example of statement: "I enjoy overcoming myself in learning achievements".

4. Self-respect motivation – the factor that includes statements related to getting satisfaction from the learning process. Example of statement: "I want to prove to myself that I am capable to study well at the university".

5. Introjected motivation – contains statements related to stimulating the study process by the sense of duty. Example of statement: "I am ashamed of being a bad student".

6. External motivation – learning based on desire to avoid social problems. Example of statement: "I don't have another choice as the attendance is taken".

7. Amotivation – statements are related to the lack of desire to study and of understanding why it is required. Examples of statement: "Frankly speaking, I don't know, I feel like wasting my time here".

This methodology is based on the self-determination theory created by E. Deci and R. Ryan (Deci et al., 2001; Deci, Ryan, 2008). The scale developed by Gordeeva, Osin and Sychev consists of 28 statements. These motivation factors include 4 statements per factor. The respondent had to evaluate each statement on a 5-point scale (from 1 – "does not correspond at all", to 5 – "quite corresponds").

This study was conducted by a Google Forms online survey. The results were processed with the STATISTICA and SPSS software. The survey engaged a total of 1,324 respondents – students of the Financial University under the Government of the Russian Federation, enrolled in all 4 undergraduate and 2 graduate years on a full-time and part-time basis, on a budgetary and commercial basis (Table 2).

Table 2. Description of respondents according to their study year

Year	Undergraduate				Graduate	
	1st year	2nd year	3rd year	4th year	1st year	2nd year
Percents	28,5	25,5	15,5	12,0	10,4	8,1

3. Results

The results of the study showed the following specifics connected to the student academic performance.

Most of the students surveyed state that their academic performance ranges from "average" to "high". Only a few of those surveyed say that their academic performance is "below average" or "low". These results may be caused by two main reasons:

1. Participating students may be subject to the "social desirability effect" when, even when anonymous, many still answer a little better than they really are,

2. Participating students indeed have a fairly high academic performance. This may be explained by the desire of well-performing students to participate in the study.

The next question the students were asked was about their own estimation of their chances to successfully graduate from university and get a diploma. Most of the respondents are confident that they will successfully graduate from the university and get a diploma. This metric is also an indirect indicator of the student academic performance since the part of the students who are sure that they will get a diploma, probably has such a personal quality as self-efficacy.

The next question asked to the students was related to their assessment of their own capability to pass the next term exams without fails. Even more students believe that they will pass the next term exams without fails. Such distribution of answers may indicate that students have successfully adapted to the educational process at the university. On the one hand, such attitude towards term exams may indicate that students do not take this period seriously enough. On the other hand, such confidence may be due to the fact that students study during the term and by the end of it are firmly convinced that their knowledge will be enough to pass their term exams without fails. Additional studies are required to confirm these hypotheses.

The next block of questions was related to original location of students, as well as whether they work while studying at the university. Most of participating students either study in the same city where they went to school (that is, are from Moscow) or moved to study in another region. The performance of these groups also differs from each other. So, for example, students who came to study to another region more often rate their own academic performance as “above average” and “high”, while students who graduated from school in the same city rate their performance more often as "average" and "above average".

The next question was related to whether the students work during the learning process. We couldn't establish a clear pattern of connection between work and academic performance. The number of students who have a regular job and who work occasionally is approximately the same. A much larger number of students answered that they did not have a job. This distribution may be due to the fact that most of the students who participated in the study are just starting their full-time undergraduate program (when they rarely work). In general, the group of those who answered that they don't have a job includes the majority of students who rate their academic performance as high. Those who answered that they have a regular job rate their performance lower than those who do not work.

The last question was related to the nature of the student's job (if they answered that had a job in the previous question). Most of the students who took part in the survey do not have a job in the same area they study (if they work at all while studying at the university). Most of those who answered that they did not have a job in the same area they study, nevertheless, assessed their performance fairly highly. Many students, as the previous stages of the research showed, experience difficulties in finding a job. Probably, without an opportunity to work in the same area they study, if they feel the need to work at all, they engage in a profession other than the one they are studying. On the one hand, this does not prevent them from performing well at the university, on the other hand, it probably causes difficulties in finding employment after graduation.

This study leads us to a conclusion that the majority of students assess their performance as average and above average. They are rather serious about getting a higher education, mostly they do not have a job, and among those who do not have a job, the majority of students rate their own academic performance reasonably highly. A complete summary of the responses to the questions in Table 1 is provided in the appendix to this article.

Next, we will analyze the results of a study of students enrolled in undergraduate programs (Table 3) (the values in the cells are the average values for various academic motivation scales, the maximum possible value is 20 points).

Table 3. Average values and standard deviations of academic motivation for student groups with various academic performance in undergraduate programs (M±SD)

Motivation Types	Academic Performance				
	Low	Below average	Average	Above average	High
Learning motivation	11,5714 ±3,704	12,0976±3,691	13,6013±3,715	14,9033±3,724	15,0864±3,594
Achievement motivation	8,8571 ±2,864	8,4390±2,797	9,6412±2,924	10,9779±2,864	11,6543±3,004
Self-development motivation	11,0714 ±3,869	11,7805±3,872	13,4352±3,859	15,1077±3,819	15,5648±3,799
Self-respect motivation	9,0714 ±4,463	10,2439±4,455	12,2226±4,503	14,1602±4,299	14,1173±4,467
Introjected motivation	6,9286 ±3,122	7,9268±3,422	9,0664±3,120	9,9309±3,135	10,0833±3,322
External motivation	11,4286±3,723	13,1463±3,729	12,0100±3,753	11,7707±3,800	11,5926±3,763
Amotivation	14,0000±4,484	12,0000±4,497	10,1462±4,184	9,0856±4,422	9,1080±4,514

The motivation of students who evaluate their own performance has a certain specifics. First, learning motivation is high when it comes to ”above average' and "high" grades. This type of motivation tends to increase with the increase in the students' assessment of their performance. Second, achievement motivation is not too different when students rate themselves as "poor" and "below average" and tends to increase when students rate their own performance as "average" and above. Thirdly, the trend towards an increase in average values is specific to most academic motivation scales, with the exception of external motivation. That is, students who are motivated only by an external behavior system, usually study at a fairly low academic level. Fourthly, the level of amotivation decreases when moving from "low" performance to "high". That means that students who are motivated to learn have a fairly low level of amotivation.

The results of the graduate programs students are presented in Table 4 (the values in the cells are the average values for various academic motivation scales, the maximum possible value is 20).

Table 4. Average values and standard deviations of academic motivation for student groups with various academic performance in graduate programs (M±SD)

Motivation types	Academic Performance				
	Low	Below average	Average	Above average	High
Learning motivation	8,0000±3,675	10,8333±3,665	14,2830±3,675	14,8636±3,722	14,8036±3,805
Achievement motivation	8,0000±2,579	8,0000±2,581	10,2830±2,619	11,1023±2,499	11,2857±2,539
Self-development motivation	10,3333±3,955	9,5000±3,945	13,1321±4,025	13,9318±3,967	14,3839±3,921
Self-respect motivation	10,6667±4,518	6,6667±4,511	11,4528±4,498	12,1818±4,527	12,1250±4,601
Introjected motivation	7,3333±3,223	6,5000±3,233	8,4528±3,199	8,5114±3,247	8,9643±3,219
External motivation	9,6667±3,602	10,1667±3,611	10,9057±3,607	10,1591±3,627	10,9464±3,598
Amotivation	14,3333±4,699	9,3333±4,671	10,5660±4,595	9,4773±4,703	10,5446±4,690

At this level of education, other trends can be noted. So, for example, compared to undergraduate programs, there is no clear dynamics of amotivation decrease and of the connection of this motivation type with the student's self-assessment of their performance. Some motivation types have an ambiguous connection with the level of assessment (for example, self-respect motivation). High values of external motivation, as a rule, according to students, are connected to high academic performance. In general, the results obtained may indicate that not many students who study at graduate programs perceive it as a way to learn something new (despite the fact that the trend of cognitive motivation increase and related increase in academic performance has repeated). Perhaps, if previously external motivation consisted in the fact that successful graduation from the university allows to get a good job, then, admitted to the graduate program, its successful completion gives a chance to move up the career ladder.

Let's follow with the results by departments.

First, we will analyze the results obtained from the survey conducted among the students of the Institute of Online Education. There were not so many students who would rate their academic performance as "low" and "below average". In this regard, it was decided to unite these students in one group.

Table 5 shows the motivation factors for the students of this Institute in descending order.

Table 5. Motivation factors for the students of the Institute of Online Education, depending on their academic performance

Performance	Low, Below average	Average	Above average	High
Academic motivation types in descending order	Learning motivation	Learning motivation	Learning motivation	Self-development motivation
	Self-development motivation	Self-development motivation	Self-development motivation	Learning motivation
	Amotivation	Self-respect motivation	Self-respect motivation	Self-respect motivation
	External motivation	Achievement motivation	Achievement motivation	Achievement motivation
	Achievement motivation	External motivation	External motivation	External motivation
	Self-respect motivation	Introjected motivation	Introjected motivation	Amotivation
	Introjected motivation	Amotivation	Amotivation	Introjected motivation

According to the results of the study, the following interesting patterns can be seen: only a small number of students assess their academic performance as “low” and “below average” (which is why these levels were united in one category). In addition, the highest values in all assessments are associated with a high level of learning motivation. Although students who rate their academic performance as excellent, put self-development motivation in the first place. Amotivation also affects students' self-assessment in different ways. At the "average" and "above average" levels, amotivation is the last factor. At the “low” level, this motivation type is in the third place, and for students who rate their own performance as “high”, this motivation type is in the penultimate place. That is, students who study at this Institute have a high level of learning motivation, their motivation level is directly related to their assessment of their studies – motivated students rate their own progress higher, students with external motivation, respectively, lower. In general, these trends are typical for all levels of assessment.

Let's analyze in more depth the results of students of the Faculty of International Economic Relations. Students of this faculty were divided into only three levels (unlike students from other faculties). The reason to do so was that only one student responded with assessment his academic performance as "low". Also, only one student out of all answered that they assessed their level of academic performance as “below average”. The results for the students of this faculty are presented in Table 6.

Table 6. Motivation factors of students of the Faculty of International Economic Relations depending on their academic performance

Performance	Low, Below average and Average	Above average	High
Academic motivation types in descending order	Learning motivation	Learning motivation	Self-development motivation
	Self-development motivation	Self-development motivation	Learning motivation
	External motivation	Self-respect motivation	Self-respect motivation
	Self-respect motivation	Achievement motivation	Achievement motivation
	Achievement motivation	External motivation	External motivation
	Amotivation	Amotivation	Introjected motivation
	Introjected motivation	Introjected motivation	Amotivation

Judging by the data in Table 6, students have a fairly standard profile related to motivational features. So, learning motivation and self-development motivation have the highest values at all three levels of the student self-assessment of their own performance. Introjected motivation and amotivation also close the scale range for students who evaluated their academic performance at various levels. Other features are also typical for students of other faculties.

Let's move to analyzing the results obtained while processing the results for the students at the Faculty of Finance. At this faculty, students evaluate their own performance at all possible levels – that is, from "low" to "high". The rest of the results are presented in Table 7.

Table 7. Motivation factors of students of the Faculty of Finance depending on their academic performance

Performance	Low	Below average	Average	Above average	High
Academic motivation types in descending order	Amotivation	Learning motivation	Learning motivation	Learning motivation	Self-development motivation
	External motivation	Self-development motivation	Self-development motivation	Self-development motivation	Learning motivation
	Self-development motivation	External motivation	Self-respect motivation	Self-respect motivation	Self-respect motivation
	Learning motivation	Amotivation	External motivation	External motivation	External motivation
	Achievement motivation	Self-respect motivation	Amotivation	Achievement motivation	Achievement motivation
	Self-respect motivation	Achievement motivation	Achievement motivation	Introjected motivation	Amotivation
	Introjected motivation	Introjected motivation	Introjected motivation	Amotivation	Introjected motivation

Students at the Faculty of Finance show a high level of amotivation when they rate their academic performance as "low". In all other cases (except for the “high” rate), they demonstrate high values on the learning motivation scale. For a high level of self-estimation, self-development motivation comes first. In addition, introjected motivation demonstrates the lowest values at all levels except for "above average".

Next, let's consider in more detail the results that were obtained in the study of the Higher School of Management students. Students at this faculty rarely rate their own performance as "low" or "below average". Other features are presented in Table 8.

The students of the Higher School of Management with different levels of self-assessment of academic performance (with the exception of "low" and "below average" academic performance)

place self-development motivation first. Only when it comes to underachieving and below-average students, amotivation is at the first place. Then comes the learning motivation. All students who assessed their own performance differently have a low level of introjected motivation. Other motivation types do not have a clear connection with student self-assessment of their own performance.

Table 8. Motivation factors of students of the Higher School of Management depending on their academic performance

Performance	Low, Below average	Average	Above average	High
Academic motivation types in descending order	Amotivation	Self-development motivation	Self-development motivation	Self-development motivation
	Self-development motivation	Learning motivation	Learning motivation	Learning motivation
	Learning motivation	External motivation	Self-respect motivation	Self-respect motivation
	External motivation	Self-respect motivation	External motivation	External motivation
	Achievement motivation	Amotivation	Amotivation	Achievement motivation
	Self-respect motivation	Achievement motivation	Achievement motivation	Amotivation
	Introjected motivation	Introjected motivation	Introjected motivation	Introjected motivation

The next faculty to be evaluated is the Faculty of Taxes, Audit and Business Analysis. For students at this faculty, the following feature should be noted: not a single student answered that their academic performance could be assessed as “low”. Other features are presented in Table 9.

Based on these data, we can see that the different level of performance assessment among students at this faculty, unlike all other faculties, is associated with self-development motivation and self-respect motivation. In addition, students at this faculty who evaluate their performance as "below average" and "average" have rather low values on the achievement motivation scale, while students who rate their own performance as “above average” and “high” have low values on the amotivation scale.

Table 9. Motivation factors of students of the Faculty of Taxes, Audit and Business Analysis, depending on their academic performance

Performance	Below average and Average	Above average	High
Academic motivation types in descending order	External motivation	Self-respect motivation	Self-development motivation
	Learning motivation	Self-development motivation	Learning motivation
	Self-development motivation	Learning motivation	Self-respect motivation
	Amotivation	External motivation	Achievement motivation
	Self-respect motivation	Introjected motivation	External motivation
	Introjected motivation	Achievement motivation	Introjected motivation
	Achievement motivation	Amotivation	Amotivation

The results that were obtained at the Faculty of Information Technology and Big Data Analysis are also interesting. The number of its students who rated their own performance as "low"

and "below average" was also small. General features identified in students of this faculty are presented in Table 10.

Table 10. Motivation factors of students of the Faculty of Information Technology and Big Data Analysis depending on academic performance

Performance	Low, Below average	Average	Above average	High
Academic motivation types in descending order	External motivation	Learning motivation	Learning motivation	Learning motivation
	Learning motivation	Self-development motivation	Self-development motivation	Self-development motivation
	Amotivation	Self-respect motivation	Self-respect motivation	Self-respect motivation
	Self-development motivation	External motivation	Achievement motivation	External motivation
	Self-respect motivation	Achievement motivation	External motivation	Achievement motivation
	Introjected motivation	Amotivation	Introjected motivation	Introjected motivation
	Achievement motivation	Introjected motivation	Amotivation	Amotivation

As the results from Table 10 show, the students at this faculty rely more on learning motivation and self-development motivation. At the same time, for the students who rate their performance as “high”, a low level of amotivation and introjected motivation is typical. External motivation is rated high only by those students who consider their academic performance as "low" and "below average". They also possess a low level of self-achievement motivation.

Let's take a closer look at the results that were obtained with the participation of students studying at the Faculty of Social Sciences and Mass Communications. At this faculty, out of the total number of respondents, only 1 person rated their own academic performance as “low” and another 1 rated it as “below average”. The rest of the data is presented in Table 11.

Table 11. Motivation factors of students of the Faculty of Social Sciences and Mass Communications depending on academic performance

Performance	Low, Below average and Average	Above average	High
Academic motivation types in descending order	External motivation	Self-development motivation	Learning motivation
	Amotivation	Learning motivation	Self-development motivation
	Self-development motivation	Self-respect motivation	Achievement motivation
	Learning motivation	External motivation	Self-respect motivation
	Self-respect motivation	Achievement motivation	External motivation
	Achievement motivation	Introjected motivation	Amotivation
	Introjected motivation	Amotivation	Introjected motivation

For students who assess their own performance as "low", "below average" and "average", high values on the external motivation scale are more typical. For students with “above average” and “high” (performance), two leading motives in the educational process are identified, as a tradition already – learning motivation and self-development motivation. In addition, we can see the feature

typical for the students of this faculty and already revealed in the students of other faculties – low level of introjected motivation and amotivation.

It is also necessary to consider the results of students who study at the Faculty of Economics and Business. The features of the students at this faculty include the following trend: these students did not choose the option of assessing their performance as "low" and "below average". Other features are presented in Table 12.

Table 12. Motivation factors of students of the Faculty of Economics and Business, depending on academic performance

Performance	Average	Above average	High
Academic motivation types in descending order	Self-development motivation	Self-development motivation	Learning motivation
	Learning motivation	Self-respect motivation	Self-development motivation
	Self-respect motivation	Learning motivation	Self-respect motivation
	External motivation	Achievement motivation	Achievement motivation
	Amotivation	External motivation	External motivation
	Achievement motivation	Introjected motivation	Introjected motivation
	Introjected motivation	Amotivation	Amotivation

Students who assess their performance as "average" and "above average" have high scores on the self-development motivation scale. Students who rate their academic performance as "above average" and "high" have low scores on the amotivation scale. Unlike students from other faculties, those students who study at this faculty demonstrate high scores on the learning motivation scale.

And the last faculty to be considered in this study is the Faculty of Law. One of the features of this faculty to highlight is that there were no students who would rate their own academic performance as “low”. Other features are indicated in Table 13.

Table 13. Motivation factors of students of the Faculty of Law, depending on academic performance

Performance	Below average	Average	Above average	High
Academic motivation type sin descending order	External motivation	Learning motivation	Self-development motivation	Learning motivation
	Learning motivation	Self-development motivation	Learning motivation	Self-development motivation
	Self-development motivation	Self-respect motivation	Self-respect motivation	Self-respect motivation
	Amotivation	External motivation	Achievement motivation	Achievement motivation
	Achievement motivation	Amotivation	External motivation	External motivation
	Self-respect motivation	Introjected motivation	Introjected motivation	Introjected motivation
	Introjected motivation	Achievement motivation	Amotivation	Amotivation

There are a few interesting features to highlight. Among them is the fact that students who evaluate their own performance at the average level have rather low scores on the achievement motivation scale. Besides, there is a high level of external motivation (in the assessment of "below average"). The other patterns are mostly similar to those found among students at other faculties. In addition, it was found that students who rate their own performance as "average" have low

scores on the achievement motivation scale. At the same time, students who rate their own performance as “above average” and “high” have low values on the amotivation scale.

4. Discussion

The results of the study conducted by the authors of this research can be compared with similar domestic and foreign socio-psychological studies. For example, the long-term study of students who entered the Higher School of Economics in 2014 revealed that motivation has an indirect effect on academic performance, and learning activity acts as a mediator (Semenova, 2016), which does not contradict the results obtained by the authors of this article, but complements and refines them.

In a study in Romania, the researchers were answering the question: is there a connection between the academic performance demonstrated by students and their feeling of well-being. By well-being, the researchers meant two main options for the evolution of the student state: either their engagement, or their burnout. For this purpose, they interviewed the students who filled out questionnaires to diagnose their burnout (they filled them out twice). After that, the data on these students' performance were obtained. The researchers used the method of path analysis that highlighted the following results: the grades received by students can be predictors of student engagement and their burnout. But their engagement or burnout cannot be considered as a predictor of their grades while at the university (Paloş et al., 2019).

Psychologists from Spain also got interested in academic performance and the factors that determine it. Since the Financial University offers a multitude of various mathematics-related disciplines, this study is of particular relevance. The researchers (Ruiz-Alfonso, Leon, 2017) interviewed 1170 students enrolled in a course in mathematics. They were asked, in particular, to what extent they found this course useful, to what extent the professor was able to explain to them the significance of this course in the learning process, etc. The results revealed several interesting features. In particular, it was found that students who feel “passion” from teachers (that is, they see that they are not the only ones interested, but their teachers are too) perceive mathematics and their intrinsic motivation to study it differently (that is, they treat this course differently). However, it has also been found that students who are interested in a certain subject show better performance in it than students who are not. In addition, it was found that the relationship between student academic performance and their perception of a course as "interesting and useful" is mediated by their intrinsic motivation. Finally, it was found that the professor's emphasis on the fact that this course will be useful to the students in the future is the factor associated with their high academic performance in this discipline.

So far, there are studies that confirm the relationship between self-efficiency of an individual and their academic performance in various educational institutions (Pravakar, 2023).

In 2017–2018, a survey of 4-6 year students was conducted at the School of Biomedicine at the Far Eastern Federal University of the Ministry of Health of Russia and the Pacific State Medical University of the Ministry of Health of Russia in order to identify the connection between academic performance, motivation, burnout and self-assessment of the quality of life in medical students. As a result of this study, it was found that academic performance and motivation have a strong direct correlation, while the correlation between motivation and burnout is negative (Kuznetsov i dr., 2019). These results are also consistent with the results that were obtained by the authors of the present article.

A survey of students at the Moscow Psychological and Pedagogical University showed that for students with high academic performance, the leading motivation type is internal learning motivation, while students with average academic achievement tend to have external motivation as leading (Litvinova, 2022), which fully confirms the conclusions made by the authors.

The study conducted by the authors of the current article is limited by its coverage – only students of one university, namely, the Financial University under the Government of the Russian Federation. At the same time, the group of respondents consists of representatives of various faculties, including Humanitarian studies – sociology, political science, philosophy, psychology, as well as Technical studies – information security, applied informatics, etc., compensating this limitation to a certain degree. Another limitation of the study is that the mean values and standard deviations in this work are presented in crosstables. However, further research should use the methods of parametric statistical analysis such as Student's t-test or ANOVA.

5. Conclusion

As earlier studies revealed, academic motivation is influenced by many factors: students' living conditions, illnesses, sports, interaction with professors and fellow students, educational and extracurricular activities (Lazcano et al., 2022; Mendo-Lázaro et al., 2022). The university can, to a certain degree, have a direct or indirect influence on all these factors. Deeper factors, including academic motivation, are more hard to correct, but they have a strong influence on student academic success.

As part of this study, a survey was conducted of 1324 students of the Financial University from all faculties, years, undergraduate and graduate studies, full-time and part-time, on a budgetary, paid or discount basis. The first stage of the study was focused on connection between student academic performance and their working and residential conditions (whether they study in the same city they graduated from school or not). As a result, it was found that those who graduated from schools other than in Moscow demonstrate a higher level of academic performance than those who graduated in Moscow. Participating students mostly do not work, and the authors did not establish a significant connection between student employment and academic performance.

The following stage assessed the connection between performance and academic motivation type. For students with "high" and "above average" academic performance, motivations for learning, self-development and self-respect are at the first place, while for students with "low" academic performance, external motivation or amotivation mainly prevails. Thus, it was found that if a student enrolled due to external pressure, most likely they will not study at A and B levels.

The results obtained can be practically used in organizing career guidance and advisory work with applicants and their parents, educational and extracurricular activities in universities, as well as for highlighting and expanding individual educational trajectories, so that students whose enrollment was based on external motivation could self-actualize in their educational organization and find those professional areas that will be of interest to them in order to improve the quality of graduate training and contribute to the development of the potential of young people.

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Appendix

Survey Results

How would you evaluate your performance at the university in general?					
		Frequency	Percents	Valid percent	Accumulated percent
Valid	Low	17	1,3	1,3	1,3
	Below average	47	3,5	3,5	4,8
	Average	362	27,3	27,3	32,2
	Above average	453	34,2	34,2	66,4
	High	445	33,6	33,6	100,0
	Total	1324	100,0	100,0	

How would you evaluate your chances to successfully graduate and get a diploma?					
		Frequency	Percents	Valid percent	Accumulated percent
Valid	0 %	2	,2	,2	,2
	10 %	1	,1	,1	,2
	20 %	4	,3	,3	,5
	30 %	9	,7	,7	1,2
	40 %	2	,2	,2	1,4
	50 %	52	3,9	3,9	5,3
	60 %	56	4,2	4,2	9,5
	70 %	133	10,0	10,0	19,6
	80 %	232	17,5	17,5	37,1
	90 %	326	24,6	24,6	61,7
	100 %	507	38,3	38,3	100,0
	Total	1324	100,0	100,0	

In your opinion, what are your chances to successfully (with no fails) pass your term exams?					
		Frequency	Percents	Valid percent	Accumulated percent
Valid	0 %	12	,9	,9	,9
	10 %	6	,5	,5	1,4
	20 %	13	1,0	1,0	2,3
	30 %	26	2,0	2,0	4,3
	40 %	20	1,5	1,5	5,8
	50 %	63	4,8	4,8	10,6
	60 %	83	6,3	6,3	16,8
	70 %	153	11,6	11,6	28,4
	80 %	207	15,6	15,6	44,0
	90 %	270	20,4	20,4	64,4
	100 %	471	35,6	35,6	100,0
	Total	1324	100,0	100,0	

You study:					
		Frequency	Percents	Valid percent	Accumulated percent
Valid	in the same city you went to school	543	41,0	44,4	
	In another city but the same region you went to school	160	12,1	13,1	44,4
	moved to study to another region	480	36,3	39,2	57,5
	moved to study to another country	40	3,0	3,3	96,7

	Total	1223	92,4	100,0	100,0
Missed	System	101	7,6		
Total		1324	100,0		

Do you have a job?					
		Frequency	Percents	Valid percent	Accumulated percent
Valid	yes, regular job (full-time)	287	21,7	23,5	23,5
	yes, regular job (part-time)	93	7,0	7,6	31,1
	yes, regular job (flextime, freelance)	111	8,4	9,1	40,1
	occasionally (project work etc.), not regularly	210	15,9	17,2	57,3
	no, I don't have a job	522	39,4	42,7	100,0
	Total	1223	92,4	100,0	
Missed	System	101	7,6		
Total		1324	100,0		

If you have a job, can you say that it is in the same area you study at the university?					
		Frequency	Percents	Valid percent	Accumulated percent
Valid	yes, the same	149	10,1	18,6	18,6
	mostly yes (has a certain connection with my future profession)	171	11,6	21,4	40,1
	mostly no (remote connection to my future profession)	149	10,1	18,6	58,7
	no, not connected	330	22,4	41,3	100,0
	Total	799	54,3	100,0	
Missed	System	672	45,7		
Total		1471	100,0		

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Educational Level and its Relationship with Digital Marketing and Internet Skills: A Study in Latina Women Entrepreneurs

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Abstract

The objectives of this work are to explore the different types of internet skills that Latina women digital entrepreneurs have, to determine the relationship between internet skills and educational level, and to analyze the way this contributes to a marketing orientation of the business, depending as well on its particular characteristics. The study involved the participation of 149 women residing in a Latin American country who self-reported to be digital entrepreneurs. The data was collected through a questionnaire that included socio-demographic elements that helped determine their educational level, as well as specific characteristics of their business, and validated scales that allow the measure internet skills and digital marketing orientation. An econometric model was used to analyze the data, which identified a significant effect of information and communication skills, as well as business characteristics, on strategic emphasis toward digital marketing. Educational level had a positive effect on the development of Internet skills. These results corroborate the importance of achieving higher levels of education for entrepreneurs, in order to facilitate the development of Internet skills. It also contributes to understanding the impact of these skills on the development of digital marketing strategies for businesses with different characteristics in terms of size, and, sector.

Keywords: digital marketing, internet skills, women entrepreneurs.

1. Introduction

Latin America has various challenges for the development of successful entrepreneurship, and different reasons can be identified to study this activity specifically in women. Saavedra and Camarena (2015) analyzed some of the main differences between genders when talking about entrepreneurship. Some of their most important findings were that females are more likely than

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men to start a business out of necessity. However, they also found that the size of the operation of companies led by women tends to be smaller than those led by individuals of the male gender.

Olson and Bernhard (2020) studied digitization and the use of social networks in female entrepreneurs operating small businesses, as well as their skills and adaptation to rapidly ocurring changes in technologies. They found that women tend to learn informally, or they rely on more proficient users to perform the tasks, that are difficult for them in digital environments. Constantly updating knowledge and skills is essential to keep a business competitive and growing; however, this can cause digital stress and burnout.

Apasrawirote et al. (2022) propose a model based on an extensive review of the literature, in which they define the environment, technology, business context, and customer behavior as contingency variables. These variables affect digital capabilities, such as marketing in social networks, digital marketing strategy, digital relationships and leadership capabilities. These elements gain importance by having an impact on the performance of small and medium-sized companies. On the one hand, they lead to customer satisfaction, meeting their expectations and generating engagement. On the other hand, this performance is measured with the growth in sales, market share, leadership, and profitability.

The above makes it relevant to contribute to the literature on this subject. Thus, the objective of this research to explore internet usage skills of Latina women entrepreneurs and to determine the relationship between the orientation towards marketing and said skills. The study also looks at some characteristics of the business, such as its number of collaborators, the age of the enterprise, and the sector to which it belongs.

2. Literature review and conceptual model

2.1. Theory on digital marketing

The internet has become a practically indispensable tool in business. A marketing manager who does not use it or who uses it inappropriately is at a disadvantage compared to those who use internet strategies wisely (Yannoupoulos, 2011). There are different approaches and definitions around Digital Marketing. Smith (2011) uses a definition close to that of traditional marketing, adding the digital part, considering it a practice in which products and services are promoted, making use of digital distribution channels or online advertising to establish communication with consumers. Nuseir and Aljumah (2020) add that it is a dynamic concept with characteristics that are needed to develop and implement successful marketing strategies.

Chaffey and Smith (2017) highlight three relevant aspects that can be obtained from digital marketing. The first tells us about the identification capacity, referring to the way in which the internet can be used for market research, which helps to know the needs and desires of consumers. The second element has to do with anticipation. With this, reference is made to the fact that the internet provides one more channel in which customers' access information and make purchases. For the correct allocation of resources in e-marketing, it is vitally important to evaluate this demand. The third element highlighted by the authors is satisfaction, which in this context encompasses elements such as the ease of use of a site, its adequate performance, customer service standards, and delivery of physical products, among others.

Techniques such as Search Engine Optimization (SEO), Search Engine Marketing (SEM) and Social Media Marketing (SMM) are part of the day-to-day operation of digital marketing in companies. Authors such as Rogers and Sexton (2012) have sought to determine ways to improve the return on investment of digital marketing. Among their recommendations were that in order to have profitable digital marketing, it is necessary to have clear objectives; even when experimenting with new technologies, it is necessary to quickly understand where you want to go. Along these same lines, care must be taken that the metrics measure compliance with the objectives set, which may mean that those used in previous periods are not currently optimal. With the above, it is necessary to take into account Web Analytics tools, which help with the collection, measurement, understanding, analysis, planning, reporting and prediction of activities on the web for businesses (Bala, Verma, 2018).

In general, it is necessary to have a comprehensive plan and generate strategies to maximize the advantages of digital marketing and minimize its possible disadvantages. Companies and their brands today interact with their audiences to meet their objectives through different tools such as email, mobile media, and social networks, among others (Bala, Verma, 2018). This makes sense according the definition of marketing proposed by Kotler and Keller (2007), in which they refer to the concept as a

social process in which both individuals and groups obtain what they want and need through the exchange of products and services, value with other individuals and groups of individuals.

2.2. Internet skills

To talk about internet skills, it is necessary to first mention the concept of the digital divide. One of the definitions of this concept is that of Kularski (2012), which refers to a gap both in skills and in physical access around information technologies. Lythreatis et al. (2022) found nine categories of factors that affect this gap: sociodemographic, socioeconomic factors, personal elements, social support, type of technology, digital training, rights, infrastructure, as well as large-scale events. Within these categories is education, an element that has been the most linked to the digital divide.

Deursen and Van Dijk (2010) propose a framework with four different levels of internet skills. The first level refers to the operational, which includes aspects such as knowing how to surf the internet, saving files on a hard drive, opening files in common formats, using search engines, filling out forms, among others. For the second level, formal skills are mentioned, some examples of which are the use of hyperlinks and not getting disoriented when navigating between web pages and when using search engines. As a third level in this framework, informational skills are suggested. These include activities such as being able to define a problem in which certain information is required, having the ability to select a website or information search system; being able to define search options, as well as to select and evaluate the information.

Last on the scale are the strategic internet skills. At this level, it is proposed that users take advantage of the internet by means of an orientation towards a particular objective, taking the correct actions and decisions to achieve said objective, as well as obtaining benefits that result from it. In general, digital competence can be understood as the combination of skills, knowledge, and attitudes related to the way in which individuals perform in virtual environments (Jiménez et al., 2016).

Scheerder et al. (2017) carried out a systematic review of the literature, in which part of their search was about the determinants of internet skills. For the most part, the determinants that were found to have been included in various investigations are those related to general digital skills and those related to content. Both sociodemographic and socioeconomic factors are among the most common found in the literature as studied elements that impact internet skills, while others less studied are the social and cultural ones. On the other hand, for content-related skills, the motivational part was found to be an important factor.

2.3. Empirical studies on DM

There are different studies that determine the way in which digital marketing impacts the performance of companies. The study carried out by Nuseir and Aljumah (2020) determined that applications allow companies to establish more effective communication with their customers, as well as to react more efficiently to the actions of the competition, emphasizing that the information provided to users must be easy to find and understand, timely, and accurate. In the same way, Saleh (2020) concluded that the use of E-Marketing can grow a family business, and that the implementation of a marketing methodology with a digital strategy can specifically help improve income and sales.

Barbosa et al. (2022) detected the way in which entrepreneurs make use of digital marketing throughout the customer journey. For the stage of creating brand awareness, the importance of generating a presence in different digital environments was detected, intended for the client to learn about the product or service. In the attraction or engagement stage, the aim is to generate content so that consumers can process and store the information in their short-term memory. Something that distinguishes the next phase, that is, the conversion phase, is the clearer positioning, making it clear to the client how the product, service, or brand is different from the competition, and encouraging purchase through tactics focused on closing the transaction.

After the purchase, customer loyalty is sought, for which post-sale strategies are carried out and online communication is reinforced so that customers do not forget the product. Finally, it is sought that a client become a defender of the brand. For this, tactics are generated in which the client is motivated to promote it with friends and family and experiences continue to be generated that strengthen the relationship.

Bhagat and Sambargi (2019) studied the impact of the personal level of innovation in female entrepreneurs, as well as their perceived ability, on the intention to adopt digital marketing. It was found that both variables significantly affect this adoption. Abed (2021) in another study carried out

with female entrepreneurs, determined that social influence and the expectation of effort are two of the main variables that impact the intention to use mobile applications. The importance of these in digital marketing lies in the fact that they allow researching the customer, launching products on the market, developing the brand and reaching different segments (Sathye et al., 2014).

With these arguments, the path of the model for the empirical study is shown below, as well as the research questions, objectives and hypotheses to be tested:

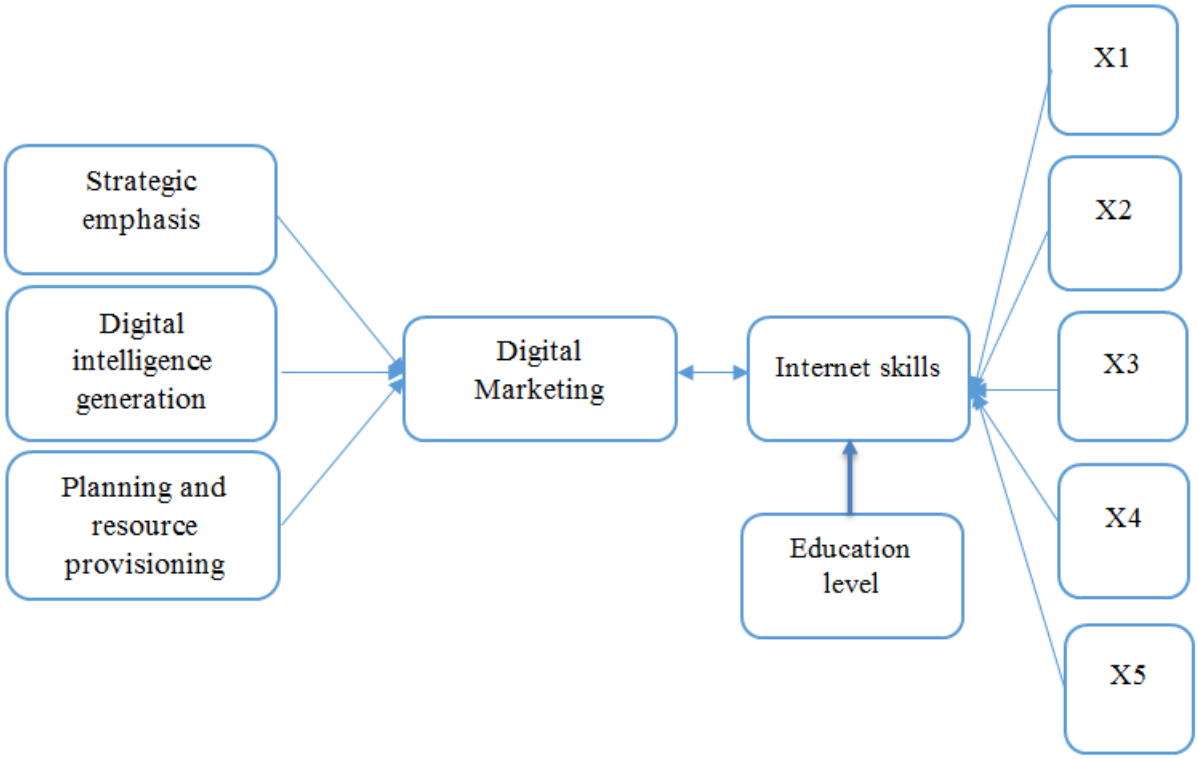

Fig. 1. Conceptual theoretical model

Study questions and objectives

What are the different types of internet skills that Latina digital entrepreneurs have? Is there a relationship between the orientation towards digital marketing with internet skills and the characteristics of the business?

Therefore, the following objectives are set: explore the different types of skills on the use of the internet that Latina digital entrepreneurs have, determine the relationship between the orientation towards marketing with internet skills and the characteristics of the business (number of collaborators, age of the venture and business sector).

Hypothesis

H1. There is a gap in Internet skills, depending on the educational level.

H2. Orientation towards digital marketing is positively related to internet skills.

H3. The components of digital marketing orientation are positively related to the different types of internet skills.

H4. The orientation towards digital marketing is positively related to the characteristics of the business (number of collaborators, age of the venture and business sector).

Design and method

The type of study is descriptive and correlational, not experimental. The sample is made up of 149 women residing in a Latin American country, who at the time of the survey application indicated having a digital business. 66.44 % of women are between 25 and 45 years old, 27.52 % are over 46 years old and only 6.04 % are between 18 and 24 years old.

For the selection of the participants, the self-determination sampling method has been followed. Data collection is carried out through an (online) questionnaire, applied during the month of February 2023. The questionnaire is made up of four sections. The first section includes sociodemographic questions about the respondent (age, marital status, educational level, place of

residence, employment status, and monthly income from the business); the second section includes questions about business characteristics (number of collaborators, age of the venture and business sector); the third section includes questions about the means by which respondents have acquired internet skills. The fourth section includes two scales: a scale to measure internet skills proposed by Jiménez and others (2016) and a scale to measure orientation towards digital marketing proposed by Mahmutović (2021).

The internet skills scale contains 18 Likert-type items, in which respondents indicate the frequency with which they perform a series of activities, whose response options are never, rarely, occasionally, frequently, very frequently. The values assigned to the responses range from 1 to 5, respectively. The scale allows to know the internet skills regarding five categories: E-Administration (administrative procedures and commercial transactions), content creation and publication in social networks, autonomous learning, privacy and security, information and communication.

In order to generate a measure, an internet skills index is built, according to the methodology of CNBV (2022). The scores of each item are added and averaged; the maximum value of the index is 90 points, which is standardized to base 100 for comparison purposes. Also, under the same procedure, the sub-indicators corresponding to the five categories are calculated.

The scale on orientation towards digital marketing contains 16 items, in which the respondent indicates the degree of agreement or disagreement with respect to each of the statements. The response options are strongly disagree, somewhat disagree, agree, somewhat agree, and strongly agree. The values assigned to the responses range from 1 to 5, respectively. The scale allows measuring the three components of the orientation towards digital marketing: strategic emphasis (towards digital marketing), generation of digital intelligence and planning and provision of resources. An index on orientation towards digital marketing is built, according to the methodology of CNBV (2022). The scores of each item are added and averaged; the maximum value of the index is 80 points, which is standardized to base 100 for comparison purposes. In addition, using the same procedure, the sub-indicator corresponding to each of the three components is calculated.

An ANOVA test to analyze the effect of educational level on internet skills is used. In addition, to analyze the relationship between orientation towards digital marketing with internet skills and business characteristics, the multiple linear regression model is used (Wooldridge, 2015). An econometric model is estimated for the digital marketing orientation index and for each of its components.

Described below:

$$y = \alpha + \beta x + \gamma z + u$$

Where,y: index of orientation towards digital marketing (components: strategic emphasis, generation of digital intelligence and planning and provision of resources).

x: internet skills sub-indicators (E-Administration, content creation and posting on social networks, autonomous learning, privacy and security, information and communication).

z: characteristics of the business (number of collaborators, age of the venture and business sector).

α and β are parameters to be estimated.

u: error term.

For each of the business characteristics, dichotomous variables are designed, in which the value of 1 indicates the presence of the characteristic and the value of 0 indicates the absence. From the estimation, the significant variables related to the orientation towards digital marketing are identified, for which the contrast statistic t is used. Under the null hypothesis $H_0: \beta_i = 0$,

$$t = \frac{\beta_i^{'} - \beta_i}{\sqrt{var(\beta_i^{'})}} = \frac{\beta_i^{'}}{\sqrt{var(\beta_i^{'})}} = \sim t_{(n-1)}$$

And α is the significance level of the test t_{tables}, is the critical value, then the testing mechanism that rejects the null hypothesis is when,

$$P[|t| > t_{tables}] = \alpha$$

3. Results

From the results, 47.65 % of women digital entrepreneurs have no previous training on the internet. Regarding the different means by which they have acquired internet skills, it is identified that 97.32 % have developed digital skills on the internet practicing in a self-taught way (learning by doing); 85.23 % have developed internet skills in a self-taught way with books, CD-ROMs, web pages, blogs, tutorials, YouTube, etc. While 79.87 have developed internet skills through informal help from colleagues, relatives, friends, children, etc.

Table 1. Percentage of women who have acquired internet skills through some means

Internet skills	Yeah	No
Previous training on the internet.	52.35	47.65
You have developed internet skills through the formal educational institution (school, institute, university, education centers, etc.).	45.64	54.36
You have developed internet skills through training courses that you have taken on your own initiative.	68.46	31.54
You have developed internet skills in a self-taught way with books, CD-ROMs, web pages, blogs, tutorials, Youtube, etc.	85.23	14.77
You have developed digital skills on the internet in a self-taught way by practicing (learning by doing).	97.32	2.68
You have developed internet skills through informal help from colleagues, relatives, friends, children, etc.	79.87	20.13
Total observations	149	

Figure 1 presents the results regarding the internet skills of women entrepreneurs in Latin America. The value of the internet skills index is 79 % out of a total of 100 %. The result of each of its components is also presented: E-Administration (82 %), content creation and publication on social networks (74 %), autonomous learning (76 %), privacy and security (78 %), information and communication (86 %).

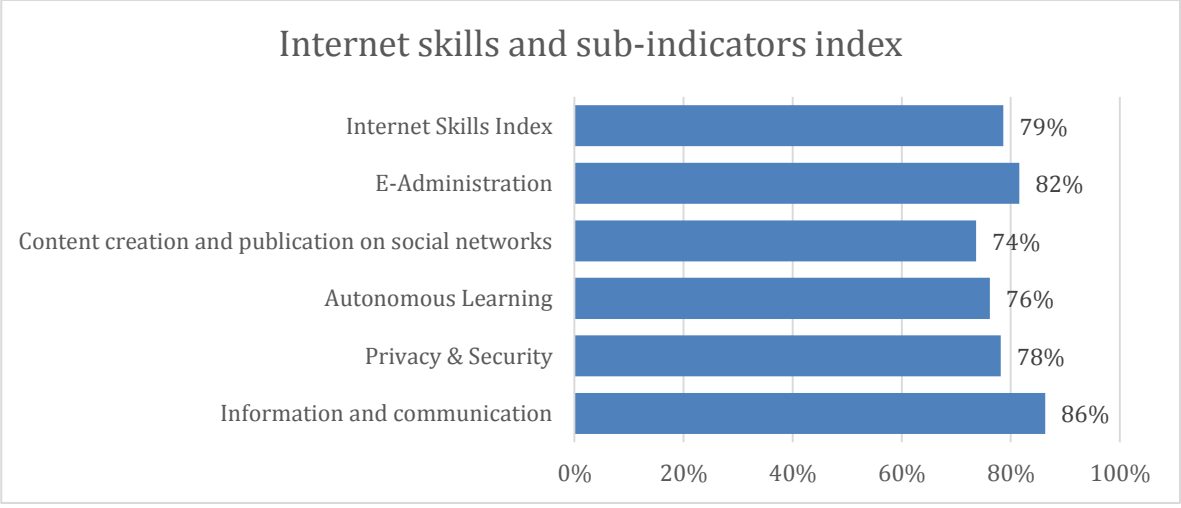

Fig. 1. Internet skills index and its components

Table 2 shows the frequency of the elements of each component. Regarding internet skills related to E-Administration, the results indicate that 62 % of Latina women entrepreneurs use the

internet very frequently as a means of communication to ask about products and services; 60 % to manage and consult their bank account, 55 % to make online purchases of products and services; and 52 % to carry out administrative procedures.

Regarding the skills of Latina women entrepreneurs in the creation of content and publication on social networks, 30 % never create or maintain Web pages or YouTube channels of their interest; 54 % create and share photos and/or videos online, as well as 48 % publish their own original content on the internet very frequently.

Regarding internet skills for autonomous learning, as shown in Figure 4, 58 % of Latina women entrepreneurs very frequently learn to solve tasks using internet tutorials and 47 % use other people's internet comments to clear up doubts; 38 % go to technical help services to solve problems; less frequently, they make periodic backup copies. In relation to internet skills for privacy and security, a high percentage of Latina women entrepreneurs (73 %) frequently and very frequently share content on the internet while respecting intellectual property; 72 % configure privacy options to protect personal data. To a lesser extent, they download and install programs.

Table 2. Frequency of use of types of internet skills

	Rating scale				
Skill Types	1	2	3	4	5
E-Administration					
I manage and consult my bank account.	11 %	5 %	5 %	19 %	60 %
I make online purchases of products and services (travel, hotels, clothes, books, theaters, movies, etc.).	11 %	5 %	7 %	22 %	55 %
I carry out administrative procedures online (studies, health, etc.).	13 %	5 %	6 %	23 %	52 %
I communicate online to ask about products and services.	9 %	3 %	7 %	18 %	62 %
I bookmark websites and services that I find useful.	11 %	5 %	9 %	18 %	56 %
Content creation and publication on social networks					
I publish my own original content on the internet.	10 %	7 %	10 %	26 %	48 %
I create and share photos and/or videos online.	9 %	3 %	5 %	29 %	54 %
I create and maintain my own websites, blogs and/or YouTube channels on topics of interest to me.	30 %	12 %	13 %	17 %	28 %
I participate in forums and social networks to communicate and be informed.	14 %	10 %	13 %	24 %	38 %
Autonomous Learning					
I learn to solve tasks using internet tutorials.	7 %	2 %	11 %	21 %	58 %
I use the comments of other people on the internet to answer questions.	4 %	6 %	21 %	22 %	47 %
I go to technical support services to solve problems.	11 %	6 %	18 %	27 %	38 %
I make regular backup copies on external devices.	20 %	12 %	19 %	21 %	27 %
Privacy & Security					
I set privacy options to protect my personal data.	7 %	6 %	15 %	20 %	52 %
I download and install programs from secure websites.	10 %	8 %	19 %	19 %	44 %
I share content on the internet respecting intellectual property.	11 %	6 %	11 %	19 %	54 %
Information and communication					
I use Google (or another search engine) to find the information I need.	7 %	6 %	15 %	20 %	52 %
I use email, video calls, and instant messaging to communicate over the internet.	10 %	8 %	19 %	19 %	44 %

Notes: 1: never, 2: rarely, 3: occasionally, 4: frequently, 5: very frequently

Regarding internet skills for information and communication, 52 % of Latina women entrepreneurs use Google very frequently to find information, while 52 % use instant messaging tools (email, video calls) to communicate online.

The digital marketing orientation index score is 68 % out of 100 %, as presented in Figure 2. The component on the strategic emphasis towards digital marketing presents the highest score (74 %), which suggests that Latina women entrepreneurs strongly agree that the application of digital marketing is a strategic need in their business, and it is a way of transferring knowledge to other collaborators.

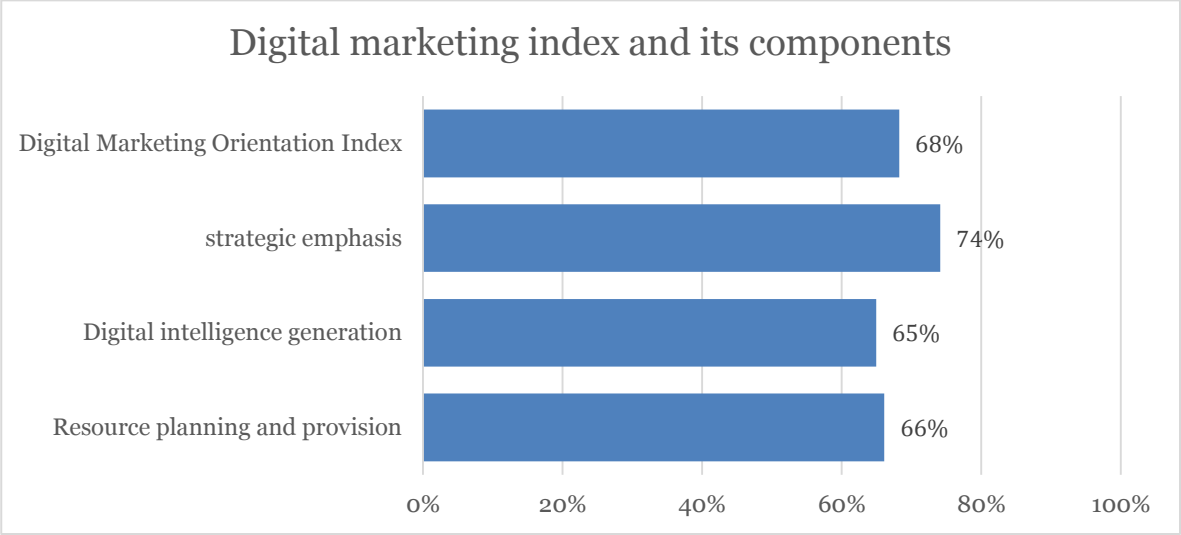

Fig. 2. Score of the marketing orientation index and its components

The score in the digital intelligence generation component is 65 %; this result indicates the degree of agreement of women digital entrepreneurs on the importance of metrics to measure the performance of the digital business and to obtain data from the different processes related to the client. The score for the planning and provision of resources component is 66 %. This result shows how important a strategic approach to their business is for women entrepreneurs, based on the strategy and the digital marketing plan to respond to the needs and requirements of customers.

To determine the existence of mean differences in Internet skills by women entrepreneurs, according to their educational level, the ANOVA test is used. Table 3 presents the descriptive statistics (mean and variance) of the Internet skills indicator scores by educational level. From the comparison of means, the women surveyed with a higher educational level (university and postgraduate) obtain the highest scores in the Internet skills indicator, compared to women with a lower educational level (secondary and technical). Under the null hypothesis of equality of means in the score in Internet skills by educational level, the results of the analysis of variance show a statistic F = 0.805 and a probability (F) = 0.492 (greater than the significance level of 0.05), indicating that there is no significant difference between the means. The previous results provide evidence of the role that the educational level of women entrepreneurs has in the skills in the use of Internet tools. The test results do not favor hypothesis H1.

Table 3. Variance analysis: Internet skills score by educational level

Groups	Cases	Sum	Average	Variance
Secondary	18	1335.555	74.197	416.202
Technical	32	2491.111	77.847	333.487
University	80	6295.555	78.694	394.273
Postgraduate	19	1596.666	84.035	399.068

Variance analysis

Origin variations	Sum of squares	Degrees of freedom	Mean of squares	F-Statistic	Probability	Critical value of F
Between groups	928.605	3	309.535	0.805	0.492	2.667
Within groups	55744.391	145	384.444			
Total	56672.996	148				

Table 4 presents the regression model of the marketing orientation index and its relationship with the internet skills index and business characteristics. Model 1 presents the results of the bivariate estimation between the marketing orientation index and the internet skills index. The result indicates that the internet skills index is a significant determinant of the marketing orientation index ($\beta = 0.564$; $p < 0.01$); Its effect is positive and significant. This provides evidence in favor of hypothesis 2 at the 1 % significance level. Thus, given an increase of 1 percentage point in the internet skills indicator, the index of orientation towards digital marketing increases by 0.564 percentage points.

Model 2 includes as independent variables the internet skills index and the characteristics of the business (number of collaborators, age, and sector). From the results, it is identified that the internet skills index is a significant determinant of the orientation index towards digital marketing ($\beta = 0.539$; $p < 0.01$), as in model 1, but none of the business characteristics (number of collaborators, age, sector) is significant.

Table 4. M.C.O estimates of the digital marketing orientation index

	Model 1 Y: digital marketing orientation index	**Model 2** Y: digital marketing orientation index
Constant	23.8257***	23.5351***
	(7.20749)	(7.54594)
Internet Skills Index	0.564969***	0.539232***
	(0.0889459)	(0.0898134)
Number of employees		
1 employee (base category)		
2 to 5 employees		4.48010
		(5.40284)
Business age		
0 to 2 years (base category)		
3 to 5 years		3.78430
		(3.94090)
6 or more years		−5.12023
		(5.09433)
Business sector		
Goods (base category)		
Services		3.85792
		(6.10208)
Goods and services		5.94115
		(4.80431)
		68.26063
Mean of the vble.		
D.E.P.	68.26063	
R-squared	0.215354	0.245917
F(1, 147)	40.34566	F(6, 142) 7.718041
p-value (of F)	2.51e-09	3.43e-07
Observations: 149		

Notes: *, **; ***: statistical significance (p-value) at 10 %, 5 %, 1 % respectively.
The values in parentheses correspond to the standard deviation of the estimator.

Table 5 presents the multiple regression models of each one of the components of the marketing orientation index, considering as independent variables the 5 sub-indicators of the internet skills index (E-Administration, content creation and publication in social networks, autonomous learning, privacy and security, information and communication), the characteristics of the business (number of collaborators, age, sector).

Table 5. OLS estimates of the components of the digital marketing orientation index

	Model 3 Y: strategic emphasis	Model 4 Y: generation of digital intelligence	Model 5 Y: planning and provision of resources
Constant	14.0484**	18.5604**	26.5799***
	(5.61061)	(9.33841)	(10.1507)
internet skills			
E-Administration	−0.111208	−0.299196**	−0.344456**
	(0.0873313)	(0.145356)	(0.157999)
Content creation and publication on social networks	0.115302	0.292898*	0.286486*
	(0.0949546)	(0.158044)	(0.171791)
Autonomous Learning	0.243963***	0.519278***	0.514099***
	(0.0878313)	(0.146188)	(0.158904)
Privacy & Security	0.0719984	0.0978234	0.0959794
	(0.0804293)	(0.133868)	(0.145512)
Information and communication	0.408502***	−0.0187327	−0.0220471
	(0.0840335)	(0.139867)	(0.152033)
Number of employees			
1 employee (base category)			
2 to 5 employees	7.22433*	3.76937	2.10934
	(3.88476)	6.46586	(7.02828)
Business age			
0 to 2 years (base category)			
3 to 5 years	2.38027	7.31729	1.65650
	(2.87731)	(4.78904)	(5.20561)
6 or more years	−9.61307**	−2.03131	−2.34697
	(3.76225)	(6.26195)	(6.80664)
Business sector			
Goods (base category)			
Services	−0.845626	1.75266	−0.353263
	(4.46579)	(7.43294)	(8.07948)
Goods and services	6.68582*	5.44512	8.31045
	(3.47228)	(5.77933)	(6.28204)
Mean of the vble. D.E.P.	74.13870	64.94407	66.12603
R-squared	0.558247	0.250534	0.189284
F(10, 138)	17.43921	4.613098	3.221994
p-value (of F)	3.64e-20	0.000012	0.000932
Observations	149	149	149

Notes: The values in parentheses correspond to the standard deviation of the estimator.
*,**;***: Statistical significance at 10 %, 5 %, 1 % respectively.

In models 3, 4 and 5 it is identified that autonomous learning is a significant determinant of each of the components of the orientation towards digital marketing($p < 0.01$). The effect is positive and significant. This provides evidence in favor of hypothesis 3 at the 1 % significance level. The effect is greater in the digital intelligence generation component and in the planning and provision of resources($\beta = 0.519$; $p < 0.05$). Thus, given an increase of 1 percentage point in

the autonomous learning sub-indicator, the digital intelligence generation sub-indicator increases by 0.519 percentage points.

In models 4 and 5, it is identified that the creation of content and publication in social networks is a significant determinant of the digital intelligence generation component ($\beta = 0.292$; $p < 0.1$), as well as the component planning and provision of resources ($\beta = 0.286$; $p < 0.1$). The effect is positive and significant. This provides evidence in favor of hypothesis 3 with a significance level of 10 %. Given an increase of 1 percentage point in the sub-indicator of content creation and publication in social networks, the sub-indicator of generation of digital intelligence increases by 0.292 percentage points.

E-Administration skills have a negative and significant effect on the digital intelligence generation component ($\beta = -0.299$; $p < 0.05$) and in the component planning and provision of resources ($\beta = -0.344$; $p < 0.05$), which does not favor hypothesis 4.

From the results of model 3, it is identified that information and communication skills are a significant determinant of the strategic emphasis towards digital marketing. ($\beta = 0.408$; $p < 0.01$). The effect is positive and significant. This provides evidence in favor of hypothesis 2 with a significance level of 1 %. Given an increase of 1 percentage point in the information and communication skills sub-indicator, the strategic emphasis sub-indicator increases by 0.408 percentage points.

The significant effect of business characteristics on the emphasis on digital marketing is also identified. The number of employees (2 to 5 employees) and the business sector (goods and services) have a positive effect on the emphasis on digital marketing. ($\gamma = 7.22, p < 0.1$; $\gamma = 6.68, p < 0.1$, respectively), while the age of the business has a negative effect $\gamma = -9.613, p < 0.05$. Thus, the older the business is (6 or more years), the emphasis on digital marketing decreases by 9.16 percentage points.

4. Conclusion

The objective of this research is to know the different types of internet skills of Latina digital entrepreneurs, as well as to determine the relationship that exists between the orientation towards marketing with internet skills and the characteristics of the business. From the descriptive results, around 60 % of digital women entrepreneurs use the internet very frequently to carry out activities related to E-Administration. The result differs from that reported by Cab Pech and others (2021), particularly regarding the use of the internet for online banking operations (15.9 %) and online purchases (18.0 %), and with those reported by Jiménez et al. (2016).

The results of the ANOVA test show the role of the educational level in the skills of women entrepreneurs in the use of the Internet. In our results of the econometric model, a positive and significant effect of information and communication skills (0.4 percentage points) on the strategic emphasis towards digital marketing is identified; the result coincides with what Cab Pech et al., (2021), reported, as well as, results of the work reported by Dominguez et al. (2022).

The results show the positive and significant effect of internet skills for autonomous learning in each of the components of orientation towards digital marketing, with the greatest effect in the component called generation of digital intelligence (0.51 percentage points). Thus, autonomous learning by Latina women entrepreneurs through internet tutorials, comments from other people on the internet to clear up doubts and consultation of technical assistance services to solve problems influence the orientation towards digital marketing. These results agree with the results reported by Cab Pech and others (2021) that show the use of the internet by women entrepreneurs (64.4 %), as a support tool for education and business training.

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Blended Learning in the Context of Digitalization: New Opportunities and Possible Limitations

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Abstract

In modern conditions, Russian universities are focused on the active introduction of digital technologies in the educational process, the use of various combinations of online and offline learning. The rapid change in the landscape of higher education determines the scientific significance of research on the effectiveness of mixed forms of student learning, including assessments of synchronous and asynchronous modes of online classes. In the course of working on the article, the authors used the results of a questionnaire survey of students (N = 1,107) conducted in June 2021, as well as focus group interviews (N = 23) conducted in May 2023. The purpose of the article is to analyze the perception of the problems and benefits of blended learning. The results of the study showed that students rate synchronous forms of online learning (video conferencing) in real time more highly (compared to watching pre-recorded video content). The advantages of synchronous forms of learning are associated with maintaining stable communications with the teacher and the group during the lesson. The formation of communication links, the ability to maintain a discussion "here and now" combines the advantages of traditional interaction in the classroom and the advantages of remote learning. The results obtained indicate the limits of the total digitalization of education, the need to create conditions for contact work. The students were asked about the effectiveness of transferring traditional forms of conducting classes (a lecture by a teacher/making presentations at a seminar) to an online environment. The students with a low level of self-organization (often distracted, combine work and study) are most critical of traditional pedagogical practices implemented online. Such students tend to blame the low level of their motivation on the ineffectiveness of blended learning. Students with a high level of self-organization highly appreciated the effectiveness of traditional forms of conducting classes online.

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Keywords: digitalization of education, blended learning, synchronous mode of learning, asynchronous mode of learning, online learning.

1. Introduction

The migration of higher education from the physical space to the digital format provides both the opening of a new window of opportunity for the introduction of innovations and creates new risks and consequences. The administration of higher education institutions is faced with the task of integrating digital experience and practices of personal interaction in the course of education, using digital technologies to improve the efficiency of the implementation of the main functions of universities (Chang, Gomes, 2022). Digital tools and pedagogical practices are shaping the design of the learning environment (Sarkio et al., 2023), which contributes not only to the development of new student competencies, but also to the preservation of educational culture.

In the new conditions, an additional difficulty lies in the need to overcome the digital divide. Although the results of research indicate that today's youth have the necessary digital competencies, formed at school and in everyday life under the influence of the constant use of gadgets. However, according to G. Janschitz and M. Penker, students are not always able to transfer their digital skills to the learning situation (Janschitz, Penker, 2022). The research results illustrate the problems caused by the lack of competence and experience in the daily use of digital technologies (Dong, 2020). Teachers in the new reality of the active introduction of digital technologies in the educational process also faced difficult decisions. On the one hand, there is an understanding in the teaching corps that digital technologies provide a wider coverage of students, the effectiveness of monitoring their progress. On the other hand, digitalization has negative aspects such as distraction, increased workload (Willermark, Gellerstedt, 2022). In the scientific literature, special attention is paid to the test system for assessing knowledge as an integral element of the digital educational environment of modern universities (Chernova i dr, 2023; Kulgemeyer et al, 2023). With the undoubted merits of test forms of control (Szeibert et al., 2023), scientists express doubts about the objectivity of these tools, justify their limitations in the course of testing students' communication skills (Simeonova, 2021).

The key problems of digitalization of education lie in a simplified approach to the content of this process, narrowing the practices of using digital technologies in the educational process. The saturation of the electronic environment with educational content cannot be considered as sufficient conditions for the digitalization of education, the transition to a new qualitative level of education in accordance with the needs of a new generation of students. The digital competencies of a teacher should include a wide range of forms of work in an electronic environment, the active use of interactive technologies. Authentic and relevant course materials that relate to practice are a key predictor of learning success in an e-learning environment (Kumar et al., 2019).

Interactivity, dialogue interaction, sustainability of communication practices are considered as factors that increase learning satisfaction (Armas-Rodriguez, Barroso-Osuna, 2020). The analysis of e-learning success factors is the subject of interdisciplinary research. The systematization of scientific works on this topic allows us to conclude that the following elements are important: social networks, gamification (Lara et al., 2020), digital technologies for assessing knowledge, and the quality of electronic educational content.

In the context of a pandemic and the need to maintain distance between subjects in the educational process, universities were able to evaluate the benefits of introducing digital technologies. Educational administrations have observed an increase in the cost-effectiveness of digital technologies due to the scalability of digital solutions (Sprenger et al., 2021). The works of Russian authors also conclude that it is necessary to actively introduce digital technologies into the educational process, use various combinations of online and offline learning components (Nagaeva, Kuznetsov, 2022). In this regard, researchers are faced with the question of how the perception of the quality of conducting classes in a digital format is changing?

The scientific literature substantiates approaches to understanding the terms "blended learning" and "hybrid learning". In this paper, the authors use the term "blended learning", as they focus on the analysis of the practice of combining traditional "student-teacher" communications and online learning. The supporters of the hybrid approach focus on transferring most of the educational process online (using online resources), while the role of the teacher is narrowed down to an advisory/supporting function (Rudinsky, Davydov, 2022).

Technological progress is transforming the practices of teacher-student interactions in the educational environment, initiating new ethical issues (Kroner et al., 2021). In addition, the generation of "digital natives", who are well versed in the flow of information (D'yakova, Sechkareva, 2019), also makes new demands on teachers. An analysis of the empirical results of research in Sweden made it possible to construct an image of an ideal teacher who is flexible, adapts his approaches to the needs of students, "teaches, not lectures" (Ideland, 2021). Thus, the analysis of scientific publications of education illustrates the relevance of studying the forms of conducting classes, pedagogical approaches and their evaluation in the student environment. Modern scientific works examine the effectiveness of traditional classes, substantiating conclusions about the limitations of "lecture learning" (Mundt, Hänze, 2023). In the changing landscape of higher education, thinking about digitalization provides an evidence-based approach to the development of new approaches to improve the quality of blended learning (Santos et al., 2020).

2. Methods

The purpose of the article is to analyze the perception of the problems and advantages of blended learning in the context of digitalization. The authors solve the following research tasks:

- Analysis of students' perception of the problems and advantages of conducting an online lecture in real time, including an assessment of the importance of traditional communications "student-teacher";
- Analysis of students' perception of problems and advantages of lecture video recording (asynchronous mode);
- Determination of the level of students' involvement in the educational process during online classes.

Research hypotheses:

1. Students of Russian universities are more focused on synchronous forms of online learning in real time.
2. Students who prefer the remote (online) form of conducting classes, in comparison with classroom classes, are less concerned about the lack of live communication, the lack of interactivity during online learning.

The authors used methods of comparative analysis, document analysis and analysis of arbitrary contingency tables. The key methods of collecting information were questionnaires and focus group research. A questionnaire survey of students was conducted in June 2021 (N = 1.107). When constructing the sample, the authors used both the snowball method and spontaneous sampling. Students of Russian universities took part in the questionnaire survey. The structure of the questionnaire made it possible to assess the level of digital competence of students, the pros and cons of digitalization, and students' preferences in terms of conducting classes online and offline. The article also addresses issues that are related to evaluating the effectiveness of transferring traditional pedagogical forms of work to online mode. To clarify a number of provisions, in May 2023, two focus groups were held with students ($N_1 = 11$ and $N_2 = 12$).

3. Results

As part of a questionnaire survey, students were asked about the perception of traditional forms of conducting classes. According to the data received, only every tenth respondent considers it ineffective to transfer traditional practices of conducting classes online. Nevertheless, almost half of the respondents (45.1 %) express doubts, believing that the lack of live communication reduces their interest and motivation.

The materials of the focus group illustrated the students' request for a mixed approach to the organization of classes. Most often, it was about conducting lectures in an online format.

Ivan B, 3rd year: "I think that the best thing is a video recording of a lecture, and seminars in the classroom. Anyway, the lecture is about listening, it doesn't matter where you sit. It's much more comfortable at home."

Tatyana V., 4th year student: "During the pandemic, I really missed the classroom, but now I think it would be good to combine online and offline."

Ekaterina D., 1st year student: "I would not want to study only online. It would be sad without live communication ... "

Answering the question about the priority forms of conducting lectures online, the majority of respondents (57.3 %) spoke in favor of listening to lectures in "real time mode". Watching a

video recording of a lecture is preferred by a quarter of respondents (24.8 %). 16.9 % do not see the difference between these forms. The resulting distributions of responses allowed the authors to draw a number of conclusions. In 2021, "pandemic fatigue" generated a request among students to return to the classroom to traditional classes. This circumstance explains the high proportion of respondents who note the relationship between the lack of live communication and a decrease in interest/motivation to study. In addition, a small percentage of students' choice of the answer option "video recording of a lecture" is due to the insufficient level of development of digital forms of education in a pandemic. During the pandemic, universities did not have time to prepare the necessary digital content of the appropriate volume and quality.

The time that has passed since the emergency transition to online mode has not fundamentally changed the digital landscape of modern universities. The quality of digitized educational content is not highly appreciated by the modern student.

Valeria K., 4th year student: "Our teachers do not know how to make videos, it is not interesting to watch and listen. It would be possible to take the experience of bloggers who are interesting to watch."

Anna D., 3rd year student: "At our university, on the portal, there are video recordings of lectures on many subjects. But to be honest, it's hard to listen to. It doesn't work for more than half an hour ... It's hard not to be distracted and force yourself to delve into it ... "

Special attention in the course of the survey was paid to the analysis of respondents' assessments of the benefits of conducting a lecture in real time (video conference/video communication with a teacher) in comparison with watching a video recording of lecture material (broadcasting a video). Most of the students surveyed are of the opinion that direct online communication (video) with the teacher during a lesson creates an accessible communication space due to the possibility of organizing a discussion, communicating online, solving questions and receiving answers from the teacher and colleagues (Figure 1).

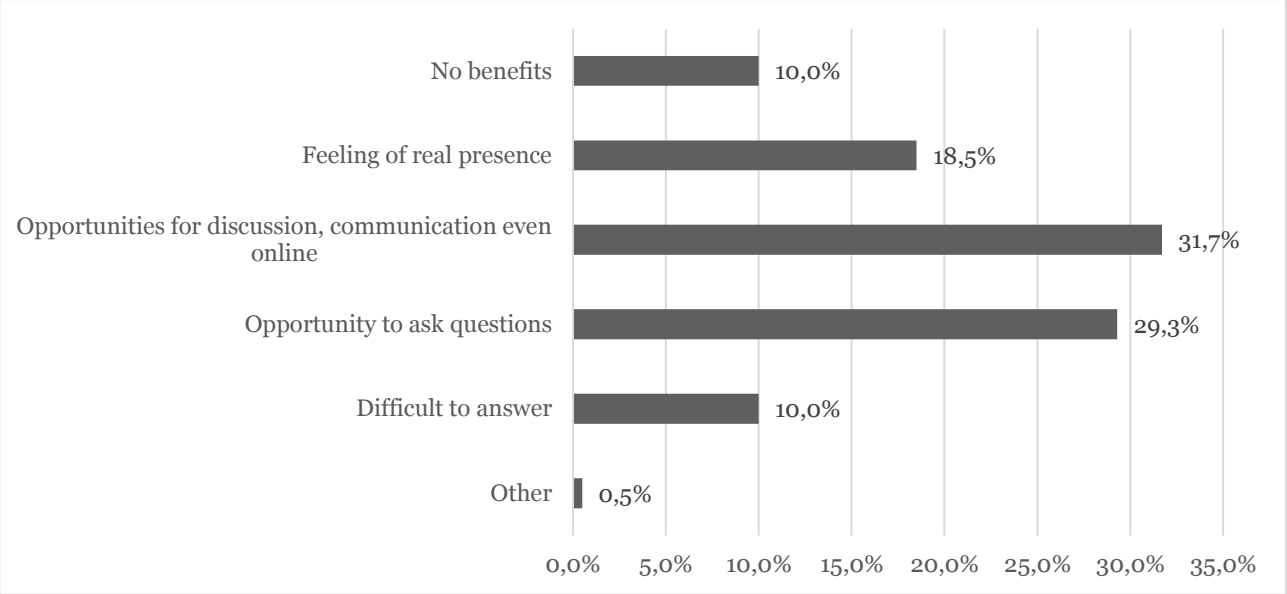

Fig. 1. Distribution of answers to the question: "What are the advantages *of holding a teacher's lecture in real time* compared to video recording?", %

On average, 29.3 % of respondents in the sample believe that the advantage of a teacher's lecture in real time compared to video recording is the ability to ask a question. 31.7 % of respondents talk about the possibility of discussion, communication even online. Only every 10 respondents could not name the benefits. In the open versions, students expressed the opinion that the real-time mode requires them to be more involved: *"there is little that distracts*", "*all of the above advantages: the opportunity to ask questions, discuss, etc.*".

Conducting a teacher's lecture in real time, unlike video recording, allows you to recreate the space of direct interaction. This circumstance is undoubtedly an advantage of the synchronous online learning format. 18.5 % of students say this.

The results of the focus groups confirmed the findings. The following opinions were voiced in the students' assessments:

Valeria K., 4th year student: "Of course, when watching the video, you can then ask a question in the chat. But it's not that ... Then you already forget. It's better to talk about it right now."

In turn, watching a video recording of lectures, according to students, has its own advantages. The following statements were made in open responses: "*there is usually a more clearly expressed thought in the recording, without distraction and pauses*", "*you can stop the recording, google something (a term that I don't know)", "you can watch it at any convenient time", "can be delivered at a faster pace, allowing for less distraction and more understanding*."

The distribution of respondents' answers indicates that the benefits of watching a video recording of a teacher's lecture are associated with better preparation of the content and the elimination of technical problems (Figure 2). In particular, recording a video lecture allows the teacher to work out the visuals more carefully using modern software, to eliminate unnecessary noise and pauses. Thus, 33.5 % of students believe that recording a lecture will provide a high quality of the technical aspect of the lesson (without interference and/or extraneous sounds); 30.2 % – "higher quality in terms of content (higher level of preparation, more thorough study of all issues)".

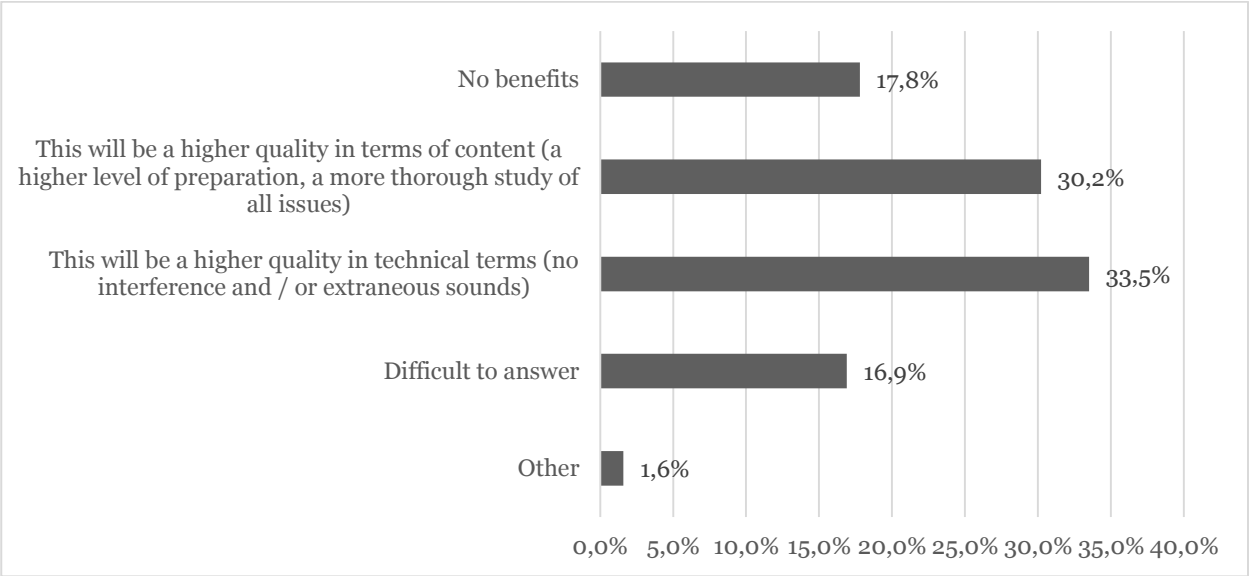

Fig. 2. Distribution of answers to the question: "What are the advantages *of watching a video recording of a teacher's lecture* compared to a lecture in real time?", %

The analysis of the data obtained indicates the actualization of the lack of live communication for those students who prefer the education in the classroom (Table 1). Such students note "lack of interactivity" less often than those students who prefer online (11.5 % and 19.9 %, respectively). Among students who prefer online learning, there is a higher proportion of those who indicate "heavy workload" as a barrier (9.3 percentage points higher than among students who prefer the traditional form of classroom learning).

Table 1. The relationship between the preferred form of education and the assessment of factors that reduce online learning, pers.

Which form of education do you prefer: traditional (in the classroom) or remote (online)	**What, in your opinion, reduces the effectiveness of online learning?**						
	lack of live communication	lack of interactivity	large loads	routine	difficult to answer	other	Total
online	125	106	116	100	54	31	532
traditional, in the	161	42	46	84	11	22	366

classroom							
difficult to answer	56	21	38	30	46	18	209
Total	342	169	200	214	111	71	1107

Table 2. The relationship between the preferred form of learning and the advantages of an asynchronous online format over synchronous learning, pers.

Which form of education do you prefer: traditional (in the classroom) or remote (online)	**What are the advantages of watching a video recording of a lecture by a teacher compared to a lecture in real time?**					
	This will be a higher quality in technical terms (no interference and / or extraneous sounds)	This will be a higher quality in terms of content (a higher level of preparation, a more thorough study of all issues)	No benefits	difficult to answer	other	Total
online	184	183	87	72	6	532
traditional, in the classroom	125	101	81	51	8	366
difficult to answer	62	50	29	64	4	209
Total	371	334	197	187	18	1107

An analysis of arbitrary contingency tables using the χ2 criterion showed that when the number of degrees of freedom is 8, the value of the χ2 criterion is 44.497. The critical value of χ2 at the significance level p = 0.01 is 20.09. The relationship between factor and resultant signs is statistically significant at a significance level of p < 0.01 (Table 2).

As the results of the student survey show, there is a relationship between the involvement of students in the educational process during online classes and the assessment of the effectiveness of transferring traditional pedagogical practices to new conditions. The results obtained showed that students who are more involved rate the effectiveness of transferring traditional forms of conducting classes to online mode higher than the average for the sample (higher than the average values for the sample by 24.2 p.p.). Among those students who are not involved in studies due to high workload at home or at work, the proportion of those respondents who consider traditional forms of conducting classes ineffective online is higher than the average for the sample (by 29 p.p.). At the same time, the inefficiency is explained by them by the lack of the possibility of interaction with both the teacher and the students.

Among those students who always listen carefully and ask questions/make comments, the following opinion was heard in open answers: "*not always <effective>, because sometimes, due to technical reasons, the connection may disappear and become unstable", "ineffective, most teachers monotonously tell not the most interesting and useful material, remotely people can simply walk away during such monologues and go about their business*." For those students who listen carefully but ask questions, the opinion that "*teachers need to adapt*" is rarely characteristic. The most critical in open statements were students who are not involved in the educational process due to being busy at work/at home. Including a lecture or a seminar as a background for their everyday affairs, students at the same time say: "*this is all outdated, it is necessary to change the teaching policy: both lectures and seminars, because what we have now does not provide any useful skills for further work by profession*".

An analysis of arbitrary contingency tables using the χ2 criterion showed that when the number of degrees of freedom is 15, the value of the χ2 criterion is 201.746. The critical value of χ2 at the significance level p = 0.01 is 30.578. The relationship between factor and resultant signs is statistically significant at a significance level of p < 0.01 (Table 3)

Thus, the results of the study showed a relationship between the assessment of the effectiveness of the practice of transferring traditional forms of conducting classes to an online format and the level of students' self-organization. Students who are sufficiently self-organized and involved in the educational process tend to be less critical of the practice of transferring traditional forms of conducting a lesson (teacher's lecture/presentation at a seminar) to an online format. Their interest and motivation are supported not by external pedagogical influence, but by internal

enthusiasm. Data visualization in Figure 3 illustrates a sharp decrease in the assessments of the effectiveness of traditional forms of online classes with a decrease in the level of student involvement in the educational process (Figure 3).

Table 3. The relationship between the student's involvement in the learning process and the assessment of traditional forms of conducting a lesson (teacher's lecture/presentation at a seminar) online, pers.

How involved are you in the learning process during online classes?	**Do you think that the traditional forms of conducting a lesson (a lecture by a teacher / making presentations at a seminar) are effective online?**				Total
	Yes, everything is efficient.	Partly, since the lack of live communication reduces interest and motivation	It is completely ineffective, since there is no possibility of interaction with both the teacher and students online	other	
I always listen carefully and ask questions, make comments	169	69	12	3	253
I listen carefully, but I rarely or never make comments and questions	175	165	20	2	362
Not involved due to being busy at work/at home, the lecture/seminar is included in the background	14	31	32	2	79
Partially involved, sometimes I can afford to be distracted by work/personal affairs	95	179	41	1	316
Often have to take a break	19	52	22	0	93
Difficult to answer	0	3	1	0	4
Total	472	499	128	8	1107

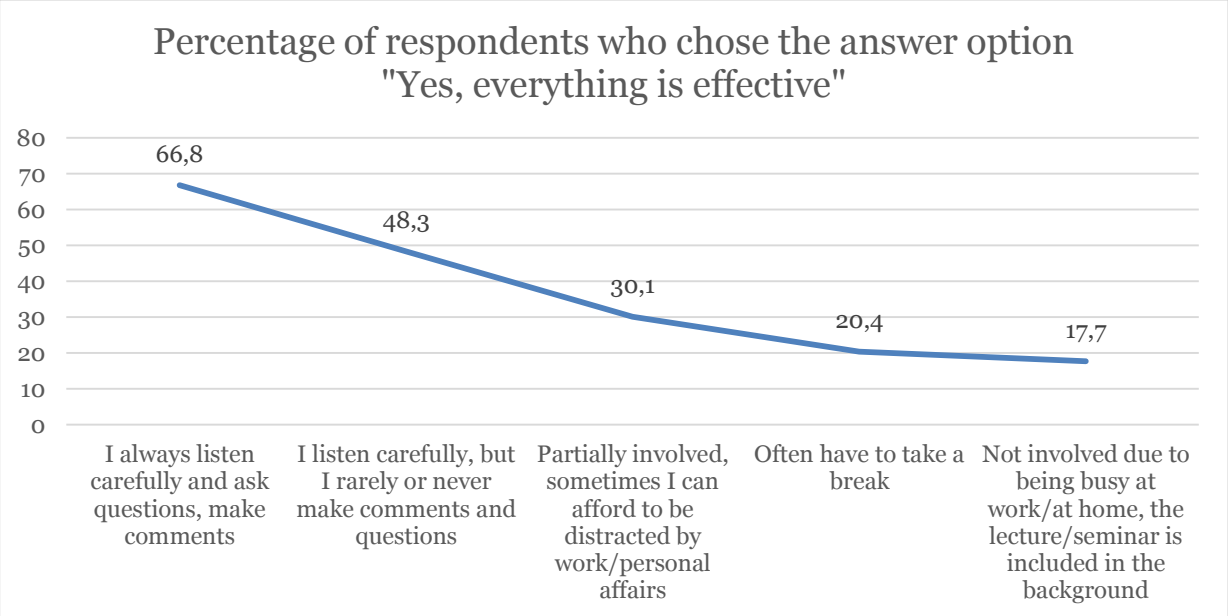

Fig. 3. Evaluation of the effectiveness of traditional forms of conducting classes online among students with varying degrees of involvement in the educational process, %

The effectiveness of blended learning is determined not only, as previously thought, by the resource capabilities of the university and the digital maturity of the teacher, but also by the student's consciousness and orientation towards active learning. A low level of involvement forces students to shift responsibility for developing interest in learning to teachers and the university as a whole, without making demands on themselves and their cognitive characteristics.

4. Discussion

The polarization of students' opinions regarding the assessment of digital forms of conducting classes. Fatigue from the pandemic has made traditional forms of lectures and seminars (in the classroom) more in demand. This circumstance led to a decrease in students' interest in impersonal forms of interaction during training (for example, lectures in video recording mode). At the same time, students were able to see the advantage of saving time on the road to the university, the opportunity to combine their everyday activities with their studies. Reflecting on the experience of the pandemic during the focus group, the respondents expressed a strong request for blended learning.

The transition to completely remote learning is not considered by students as a priority format for obtaining education. The wide representation of video content and the content of the electronic educational environment do not reduce the severity of the problems of remote learning (Frolova, Rogach, 2021).

This conclusion finds partial confirmation in the studies of Russian authors (Ustinova i dr., 2021). Scientists conclude that online learning is characterized by difficulties in self-organization of students, health problems, dysfunctions of knowledge testing, narrowing of dialogue communications. Post-pandemic studies also focus on the risks of "continuous e-education": deterioration in psychological health, information overload (Bermus, 2023).

The results of a qualitative study showed a low demand for digital educational content. Students compare the presentation of lecture video material and entertainment content that is broadcast on the network. On the one hand, this indicates the high expectations of students, the danger of stereotyping thinking, where the meaning of education is reduced to the ability to entertain (Frolova, Rogach, 2022). On the other hand, the results obtained may indicate the dysfunction of the digitalization of the educational space of the university (low digital skills of teachers, lack of digital infrastructure, etc.). According to E.V. Gnatyshina and A.O. Belousova digitalization of education should not be reduced to the creation of a digital copy of the usual textbooks. The value-semantic basis of the digitalization of education, in their opinion, should be the new digital skills of the participants in the educational process (Gnatyshina, Belousov, 2019). In the context of active digitalization of all spheres of public life, educational institutions should make significant efforts to adapt educational practices to the new challenges of the digital age. High expectations regarding the digitalization of education dictate the need to update hybrid forms of education (Holmgren, 2022).

The data obtained during the study made it possible to conclude that students need synchronous learning. The opportunity to immediately ask a question, express your opinion in the discussion "here and now" combines the advantages of traditional interaction in the classroom and the advantages of remote learning. The results obtained indicate the limits of the total digitalization of education, when even the high quality of educational content does not make up for the lack of contact work. As the research results show, it is the communication between the student and the teacher that is perceived as the highest space of dysfunctions in online learning (Frolova et al., 2023). The problem of the lack of live communication is most acute for the category of students who prefer traditional classroom classes. For all the students surveyed, the advantages of conducting online lectures in real time are associated with the presence of a communication space "here and now".

The assessment of the limitations and advantages of various learning formats (synchronous/asynchronous online learning) is determined by subjective preference, orientation towards the traditional (in the classroom) or remote form of education. The unifying feature of groups of students who express differences in priority forms of education was the understanding of the technical and content aspects of ensuring the quality of digital educational content (video recording of a lecture). Both groups of students see the benefits of delivering live online lectures in direct interaction. There is a high potential for blended forms of learning, which maintain a wide space for interaction and create comfortable conditions for participants in the education system.

The criticism of mixed forms of education is due not so much to objective factors as to subjective reasons. In particular, the low involvement and interest of students, combined with weak self-organization, creates excessive demands on the teacher's ability to diversify the learning process in an online format. It should be noted that in the scientific literature, when studying the processes of digitalization of education, attention is primarily focused on the role of the teacher, his digital competence, the need to change the usual educational practices, methods of involving students in active communication (Doz et al, 2023). However, the results obtained by the authors outlined a new direction of research. The results of the author's research showed that the effectiveness of learning in the context of digitalization is determined not so much by digital competencies, professional skills, and the charisma of the teacher, but by the level of responsibility of the student, his desire to acquire knowledge. A deeper understanding of the dependence of student motivation on subjective causes and conditions is required: employment at home and at work, the desire for quality online education, the ability to self-organize and learn. The research materials showed a direct correlation between the assessments of the effectiveness of transferring traditional pedagogical practices to the online environment and the level of student self-organization. It can be assumed that students with a high level of motivation do not expect additional "digital incentives". Such students believe that traditional pedagogical practices are quite effective and sufficient for obtaining a quality education. The results obtained are confirmed by other studies that substantiate the importance of maintaining subject-oriented learning, maintaining the trends in the humanization of education (Manikovskaya, 2019), and a reasonable combination of traditional and digital pedagogy (Kryukova, 2018).

5. Conclusion

The results of the questionnaire survey confirmed the research hypotheses. An analysis of the respondents' ratings showed that students see more advantages of lecturing via videoconference (synchronous forms of learning) compared to watching pre-recorded video content (asynchronous forms of learning). The perception of the advantages and disadvantages of synchronous/asynchronous forms of learning is determined by the preferences of students, their orientation towards online or classroom classes. Students who prefer traditional forms of conducting classes in the classroom are more focused on synchronous forms of online learning in real time. The second research hypothesis received partial confirmation. Students who prefer a remote (online) form of conducting classes in comparison with classroom classes are less concerned about the lack of live communication, however, they are more sensitive to the lack of interactivity in the course of online learning.

Blended forms of learning show their limitations for students with a low level of self-organization. The narrowing of control over the involvement of students online initiates such destructive practices as distraction to work and personal issues, the perception of lectures as a background for everyday affairs. At the same time, such students tend to blame the low level of their motivation on the inefficiency of mixed forms of education. This trend has become widespread, creating a stereotype about the low quality of online learning with the high availability of this form of education. For students with a high level of self-organization, blended learning opens up new opportunities, while maintaining all the advantages of online (the ability to review class records, save travel time, etc.). Further areas of research may be the following: analysis of the "limits" of digitalization of education, the possibility of a "turn" to the established, traditional roles and values of pedagogical practices, the development of humanization of education in the context of digitalization, the effectiveness of test tools for assessing students' knowledge.

6. Limitations

The limitations of this study include the use of a random sample, which does not fully reflect all categories of students. In order to clarify the results obtained, it seems appropriate to differentiate the opinions of students of humanitarian and technical profiles of education.

7. Declaration of Competing Interest

The manuscript’s authors declare that there is no interest in conflict, and all reference materials were dully acknowledged.

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Between Income, Savings and Investment, How Do College Students Perceive Money Management?

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Abstract

The aim of the study is to evaluate the factorial solution that explains financial knowledge in the topics of income, savings, investment and how students perceive money management. For this purpose, the EFA and the SEM methodology are used. To obtain the information, a non-probabilistic sampling by self-determination was carried out, applying the instrument in electronic format and for the analysis; the EFA and SEM methodology was used. At the end of the estimated time for data collection, 596 participating students were achieved. The items of the variables income, savings, investment and money management from the scale used in Contreras (2016), were used. The main finding is the structure obtained from the confirmatory analysis, which presents acceptable indices of absolute goodness of fit, structural adjustment, and parsimony that allows us to understand how the student perceives income, savings, investment, and money management. The values obtained are acceptable based on the suggested theoretical criteria (RMSEA = 0,054; CMIN/DF = 2,749; GFI (,951), AGFI = ,926; PGFI = ,634; TLI = ,906; CFI = ,929; and parsimony: PRATIO = ,762; PNFI = ,681; PCFI = ,707). The result has practical implications for educational institutions, considering that in the academic training of students it is essential to encourage habits related to money. Considering that, economic income is a resource that they will have in their future when they work, then it is related to the habit of saving and investing, to this, we add the good and proper management of their personal finances, and finally, the cycle of promotion to savings.

Keywords: saving, credit, investment, money management.

1. Introduction

At the international level, the importance of providing access to the entire population to the use of available financial services is observed. That leads to promoting the increase in financial education (FE) worldwide to contribute to this purpose. However, despite the joint efforts that

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have been made, it has not been possible to increase the population's banking use as planned. The importance of the financial literacy (FL) and financial education (FE) in the international context is due to the current need to address the problem of poverty. Undoubtedly, the issue of FE continues to be in the academic discussion of researchers on the subject throughout the world.

Agasisti, Barucci, Cannistrà, Marazzina and Soncin (2023) recently carried out an experiment with college students in Italy, which consisted in the implementation of an innovative course on financial education topics. The course was applied online and after was compared to a traditional conference on the campus of the University. After a week in the tests prior to the course, an increase in the score of four points out of 10 was identified. In addition, they did not find the existence of significant differences between online and face-to-face learning, which evidently suggests that digital learning has a positive effect.

With the same idea, Sconti (2022) carried out an experiment on students (n = 650) of Generation Z also in Italy, which also involved the implementation of a FE program that they called "Futuro Sicuro" (sic). With the experiment, they obtain data in two experiments, one of them from the traditional FE program with an advisor and the other, derived from a digital FE program with web applications based on game-based learning. Subsequently, after three weeks, they evaluated the results and demonstrated that in both cases the level of knowledge increased, with a notableincrease in the financial skills of all the participants.

On the other hand, Lusardi et al. (2021) reported that only 3 % increased FE in a 3-year study period (from 2017 to 2020), given that only this percentage managed to correctly answer topics related to their financial knowledge (FK). The increase in FE was observed more frequently in the female gender, as well as in people with a lower educational level and young people; Furthermore, in people who receive a low salary and in those who had a disability. Jamie (2019) also reported agreement with this study.

On the issue of FE, there have undoubtedly been constant changes in the globalized world, which brings with it risks that are difficult to foresee and consequently important measures must be taken in this regard. At the time, Lusardi and Mitchell (2011) developed a study in which they stated that financial decisions must be highly reasoned and must be informed. In their study they report important findings in this regard, for example, they point out that people who have greater financial education increase the probability of planning their retirement plan, but not when other instrumental variables intervene, in which retirement plans are dismissed by the people. Another important fact that they expose is the low level of FE in women, as well as that of the young and the elderly, all this compared to men and middle-aged people and, those with greater knowledge of financial issues.

In the Latin American context, Frisancho (2023) evaluates the effect of an intervention on behavior in the financial education class. At the end of the course, notable progress was observed by the students in financial topics. One of the significant changes was reflected in financial behavior measured by financial autonomy. In Mexico, significant changes are proposed in terms of school education, since in August 2023, materials alluding to FE will be included in textbooks, according to Wilfrido Pera Curiel, senior director of Condusef (by its acronym in english National Commission) for the Defense of Users of Financial Services in Mexico), in his speech in the week of Financial Education. The proposal is that the didactic materials of the educational offer of the Condusef be included in schools throughout the country as soon as possible (Torres, 2022).

A couple of years before, this proposal had been proposed to be carried out, but the phenomenon of the Pandemic caused by Covid-19 changed the plan, although it was possible to implement it in the CONALEP system and the Technological Universities, which was already an important advance. In this regard, we can point out that FE is a key or determinant issue in people's lives and very particular to young people, which will undoubtedly allow them to have more reasoned decisions in the management of their personal finance in the short, medium and long term. According to these arguments, and considering that the students are in advanced school cycles in the different careers, emerge the next question.

Question Research: What level of FK do university students have? In the specific case of savings, investment, income and money management? In addition, what is the confirmatory factorial model that best explains the relationship between income, savings, investing and money management?

Objective: Evaluate the factorial solution that explains FK in the income, savings, investment and money management. As well as, evaluate the best fit of the measurement model, from the absolute fit, structural fit and parsimony.

Hypothesis:

H1: There is a relationship >,5 between economic income and money management

H2: There is a >,5 relationship between saving-investment and money management

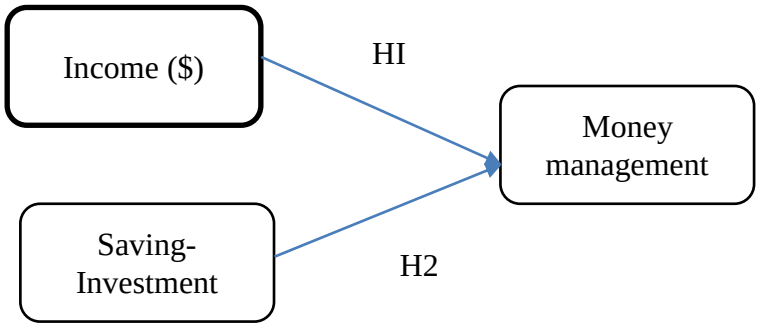

Fig. 1. Conceptual model

2. Literature review

There are various studies that have addressed the issue of financial education, one of them is a systematic and bibliometric study in which they evaluate 502 scientific articles that were published between 2000 and 2019 (Goyal, Kumar, 2020). The purpose of the study focused on identifying the most relevant aspects that have been documented in terms of financial education from three lines:

a) The level of FE in different cohorts;

b) The influence of the FE on planning and financial behavior;

c) The impact of the FE.

The findings report evidence of a significant gap in some aspects, which are summarized in: financial planning and behavior, digital financial education, as well as tax and insurance knowledge.

The lack of financial knowledge towards certain basic products and services is undoubtedly a very delicate absence in people's knowledge, since they can make erroneous decisions that lead to an economic affectation. This can be slight or even very serious, since that can lead them to sell their most valued property, such as their home (Xue et al., 2020). In fact, financial concerns are closely related to financial illiteracy, which has led to greater indebtedness among people. In addition, it has been documented with significant results that financial education makes the difference be1tween financial behavior and the use of financial instruments, the latter related to the level of financial inclusion (Swiecka et al., 2020). In the same way, it is related to savings, since, having a low level of financial inclusion, it is indicative that savings suffer a decrease and in many cases, a total absence of this. Although people with greater financial knowledge increase the probability of having formal and informal savings, they also prepare for retirement and acquire long-term financial plans, with the probability of acquiring private pension insurance (Niu et al., 2020).

It has been shown that sociodemographic factors influence in attitude, behavior and financial ability. An example of this is the work of Sahul and Jia (2020), who carried out a study in Malaysia. In their result, demonstrate that the socioeconomic factors, like marital status, income level, number of credit cards they have, ethnic origin and educational level, have influence the decision to pay credit cards. Douissa (2020) presented similar results in the study carried out on students at the University of Sharjah in the United Arab Emirates. The main finding show that the socioeconomic factors such as gender, educational level, financial inclusion, family income, among others, have influence in the behavior and financial ability.

On the other hand, compared to the Mexican student, Colombian students have high levels of financial knowledge about the use of credit cards, investments, savings, the topic of inflation, saving for retirement and diversification of risk (Ramos et al., 2020). The gender gap at an early university age has also been reflected in the American context, since prior to this they failed to develop financial skills within the home (Al-Bahrani et al., 2020). Some studies report a good level of FE, denoting that people between the ages of 15 and 16 have a medium to high range of financial knowledge, being 45,3 % and 43,8 % for each case (Swiecka et al., 2020). In relation to savings, the

perspective of economic income that will be had in the future, has been reported as a favorable attitude towards the care of personal finances in high school students (García-Santillán, 2020).

Other efforts to study these financial aspects is the work of Dinc, Cetin, Bulut and Jahangir (2021) who take up some important aspects that were suggested by DeVellis (2003) and carry out a study in which they design a scale to measure financial inclusion, which aligns with the requirements of the Islamic financial sector, including other sectors not related to the financial field, as well as those who are not familiar with financial practice. In the United States, Lusardi, Hasler and Yakoboski (2021) show that financial fragility is related to financial education and a large part of the American population is not prepared to face financial decisions to face a financial crisis such as Covid-19. The groups most susceptible to this financial fragility are African Americans and those with low incomes.

The relationships between demographic factors such as age, level of education, marital status and economic income have provided significant evidence, in the case of the pension plan (Sembiring, Leon, 2021), however, it has been shown that people with a higher level of FE tend to be more reckless (Kawamura et al., 2021). Likewise, sociodemographic factors such as age, gender, income level, marital status and education have an influence on the level of financial education in the young population; in addition, it is directly related to financial attitude and behavior (Garg, Singh, 2018). On the topic of FE, studies are frequently developed where parental income is integrated as a variable. These works have shown that students tend to have a better level of financial knowledge, which improves their financial attitude, since the learning they receive from their parents allows them to have less worry about paying student loans (Aydin, Akben, 2019; Fan, Chatterjee, 2018).

Furthermore, financial socialization influences financial attitude and the teaching learning from parents to young people generates a favorable impact on the behavior of their children (Zhu, 2018). It is evident that there are still gaps to address in relation to financial knowledge, not only in developing countries, but also in those with greater development (Klapper, Lusardi, 2019) since studies have shown that only one in three adults have FK. However, not only sociodemographic factors have influenced, but also the characteristics of the context in which people develop (Cucinelli et al., 2019).

Unemployment, low-income level and lower educational level in single people are undoubtedly factors that determine financial illiteracy. Evidence of this is the work of De Beckker, De Witte & Van Campenhout (2019), in which they cover 12 countries (Belgium, Canada, Croatia, Estonia, Hong Kong, Jordan, Latvia, Malaysia, Netherlands, New Zealand, Thailand and the United Kingdom) whose findings suggest that single people, with the characteristics previously referred to, have low levels of financial literacy. Otherwise, people with a higher educational level have greater knowledge, better behavior and a better financial attitude, as demonstrated by the results in the case of participants from Belgium, Canada, Hong Kong and New Zealand.

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A similar case is observed in women and people who do not speak the language of the country where they reside and their level of reading and writing is deficient (Karakurumet al., 2018), this results in a low level of financial knowledge. However, the literature has shown that self-employment influences the level of FE; otherwise, with a lower level, the tendency will be to work as a salaried employee (Ćumurović, Hyll, 2018). Similarly, some studies have measured the level of FK in managers or owners of small businesses. Their results did not prove that FK is related to the performance of their activities, although in decision making it was shown that it affects knowledge, at the EF level (Eniola, Entebang, 2017).

These arguments allow us to understand the existing gap in FE, which has several edges. On the one hand, the difference between genders has been documented, including the knowledge acquired at an early age from home, the effect of socioeconomic variables on FK, just to name a few aspects. Therefore, for this study it is relevant to be able to understand the relationship that exists between the incomes that the person will receive in the future, savings and investment and money management, in the particular case of students. Now the method to develop the empirical study is presented:

Design and method

The study is of a non-experimental, cross-sectional, exploratory and confirmatory design, which focuses on evaluating the factorial solution that explains financial knowledge in relation to income, savings, investment and money management, in order to evaluate the best fit of the measurement model, based on absolute fit, structural fit and parsimony. The context in which the research is carried out is in Mexico, in a higher education institution, where authorization was given to apply the survey.

Using a non-probabilistic self-determination sample, the instrument was designed in electronic format and the link was sent to the students so that they could answer the survey. At the end of the term for the application of the test, 596 cases were obtained.

The items of the variables under study, were taken of the scale used by Contreras (2016), which was validated using global Cronbach's alpha (α=,742), for each items >,7(see annex 1) and multivariate normality is verified with asymmetry and kurtosis according to Kim's (2013) criteria. The database is analyzed using AFE with Varimax rotation and principal component extraction. Subsequently, with the factorial solution of the exploratory model, the confirmation of the model is carried out using the SEM methodology. In addition, Bayesian analysis is used to verify the maximum likelihood of the parameters of the variables under study. IBM software, SPSS AMOS v23, is used at all times.

3. Data analysis

The descriptive results of the participants' profile are shown in Table 1.

Table 1. Descriptive of the profile

Variable		Frequency	Percentage
Gender	Male	307	51,5
	Female	289	48,5
Age	17 years old	1	0,2
	18	61	10,2
	19	130	21,8
	20	167	28,0
	21	134	22,5

	22	65	10,9
	23	21	3,5
	24	8	1,3
	25	2	0,3
	29	7	1,2
Civil Status	Free union	62	10,4
	Separate	14	2,3
	Divorce	1	0,2
	Marry	9	1,5
	Single	502	84,2
Labor Status	Only study	425	71,3
	Study and work	169	28,4
	Looking for work	2	0,3
Income $$	Less to 3 thousand	143	24,0
	from 3 to 4,999	21	3,5
	from 5 to 7,999	7	1,2
	More than 20 thousand	3	0,5
	NA	422	70,8
Medical Services	IMSS	321	53,9
	ISSSTE	172	28,9
	Hospital Pemex	7	1,2
	Without	11	1,8
	Unknown	85	14,3
Family relationship	Husband or Wife	28	4,7
	Song	393	65,9
	Grand song	34	5,7
	other	45	7,6
	Without relationship	38	6,4
	NA	58	9,7

Table 2. Bartlett test of sphericity

Measure Kaiser-Meyer-Olkin of sampling adequacy		,793
Bartlett Test of sphericity	Aprox. Chi-squared	4180,675
	df	595
	Sig.	<,001

Table 3. Rotated component matrix

Items of the rotated scale	Income$	Money management	Saving and investment
V5. Do you consider that the main source of income for students is provided by a part-time job.	,731		
V3. The tax increase affects the stability of the companies and increases the instability of the employees.	,733		
V2. Taking extracurricular training courses, in a job, results in earning more money because it is more valuable to your company.	,713		
V4. One of the main sources of income for adults between the ages of 20 and 35 are wages, salaries and tips.	,674		

V6. The amount paid in taxes is proportional to the salary received.	,508		
V9. There is more life insurance coverage for women.		,624	
V13. The income you obtain must be distributed for transportation, clothing, telephone service, and footwear		,588	
V14. For savings, a percentage of the amount received must be allocated.		,583	
V15. You consider that from the upper secondary education you should manage your money.		,558	
V11. Consider that the health insurance you receive is from your parents.		,528	
V10. Health insurance is suspended if the person is unemployed.		,508	
V18. Do you consider that you are familiar with the financial products and services offered by Financial Institutions in terms of investments?			,730
V17. Saving is money that is reserved for emergencies.			,730
V16. Savings must be made depending on the price of what is to be purchased.			,627
V19. Investment fund operations are carried out in financial institutions			,525

As can be seen, in Table 2 the values of the sample adequacy measure (KMO) is significant (,793), as well as the Chi-square value (4180,675) with 595 degrees of freedom and p-value < ,001 in the matrix of rotated component. Using the maximum likelihood method, the initial measurement model described in Table 3, was validated and confirmed (Jöreskog, Sörbom, 1986). For this process, the SEM methodology is used, understanding that there are several fit indices to evaluate structural models (Hu, Bentler, 1995; Hu, Bentler, 1999; Mac Callum et al., 1996). Some researchers suggests using the indicators χ^2= with *df*, p-value, CFI, GFI, TLI, RMSEA (Schreiber et al., 2006), without dismissing the rest of the indices obtained with the AMOS software, only that the theoretical criteria established in these SEM methodologies must be taken into account.

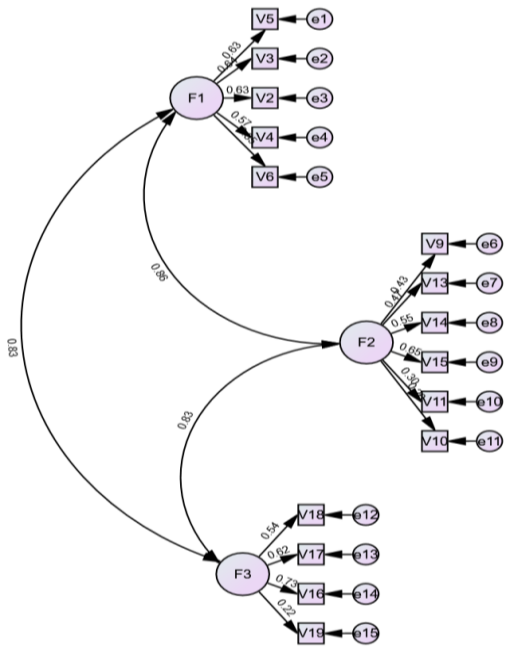

Fig. 1. Model 1

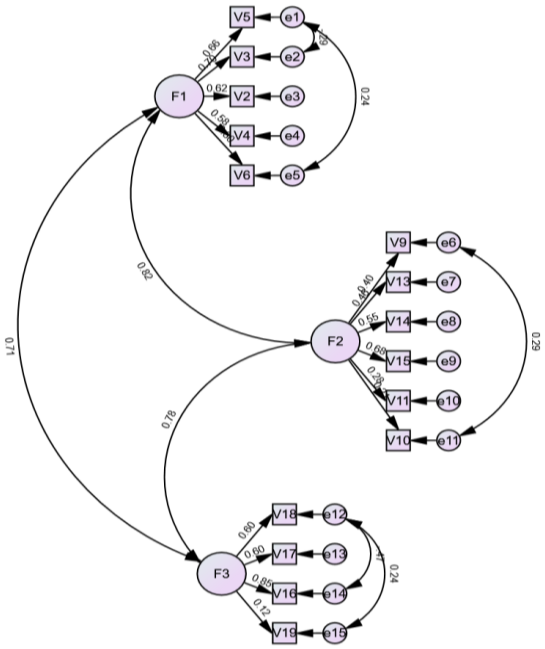

Fig. 2. Model 2

Figure 1 shows the trajectories of the three constructs with a significant relationship between the three constructs (> .8), however, the loads of the estimators in some cases are very low (v19, v11 and v10). As Carmine and Mclver (1981) suggest, CMIN/DF values should be in the range of 2,1 to 3,1, although there are criteria that have suggested that less than 2 represents a good fit (Ullman,

2006). In the case of model 1, the CMIN/DF value of 5,216, as well as RMSEA (0,084) do not represent a good fit, although the parsimony presents indicators >.5 (PRATIO ,829; PNFI ,646; PCFI ,673).

For model 2 of Figure 2, we proceed to correlate the errors e1 with e2, e1 with e5 of the construct F1 (called Income $), in the construct F2 (money management) e6 is related to e11 and finally in the construct F3 (Savings) e12 is correlated with e14 and e12 with e15. The CMIN/DF values 3.437, as well as RMSEA (.064); do not adjust to the expected values, although parsimony does show values that exceed the threshold > ,5 (PRATIO ,781; PNFI ,674; PCFI ,701).

As mentioned above, now a third model is run where e10 is correlated with e11 of the latent variable F2 (Money Management) and e14 with e15 of the latent variable F3 (Savings). Now CMIN/DF 2.749 values are obtained, as well as RMSEA (0,054); which show a better fit, parsimony shows values that exceed the threshold >.5 (PRATIO,762; PNFI ,681; PCFI ,707). The goodness of fit index (GFI) shows us the variability explained by the measurement model, which presents very acceptable values (,951). According to Jöreskog and Sörbom (1986), the closer to 1 its fit will be more perfect versus close to zero would show a poor fit of the model, hence any value >,9 is a fit that is considered acceptable.

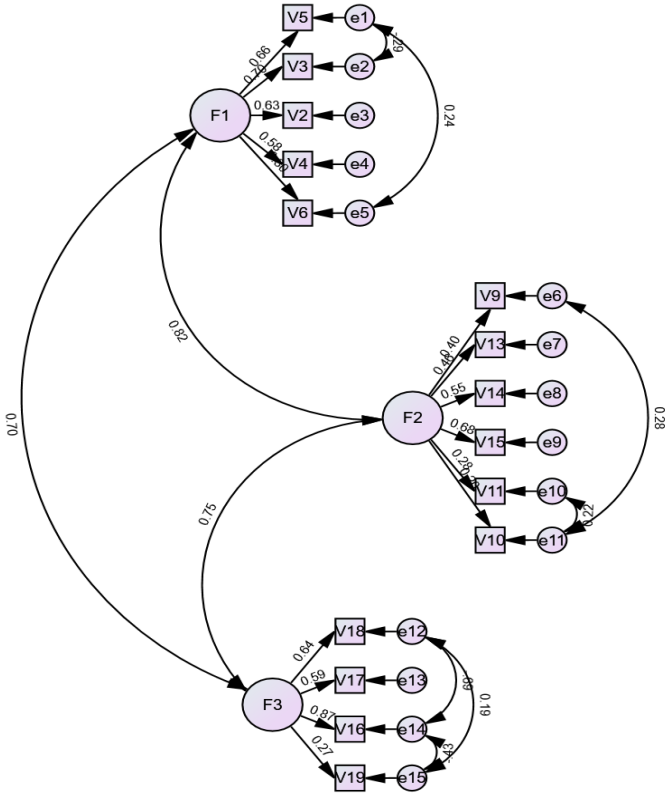

Fig. 3. Model 3

Table 3. Summary of the goodness-of-fit measures

	RMSEA	CMIN/DF	RMR	GFI	AGFI	PGFI	TLI	CFI	PRATIO	PNFI	PCFI
Model 1	,084	5,216	,097	,900	,862	,653	,774	,813	,829	,646	,673
Model 2	,064	3,437	,082	,936	,906	,640	,869	,898	,781	,674	,701
Model 3	,054	2,749	,071	,951	,926	,634	,906	,929	,762	,681	,707

According to the theoretical criteria, model 3 shows the best fit. The CMIN/DF indicator (2,749) is in the suggested range 2,1 to 3,1 (Carmine, Mclver, 1981; Kline, 1998; Ullman, 2006), although less than 2 would also reflect a good fit. In relation to the GFI and AGFI, values > ,90

close to 1 are suggested, otherwise it would indicate a poor fit of the model. Model 3 presents an acceptable GFI (,951) and AGFI (,926), as well as the RMSEA indicator (0,54), which represents the approximation error of the model with reality. We will remember that the RMSEA, also called RMSE, does not require comparison with a null model, it is even the least affected by the sample size, but when the samples are small, it overestimates the goodness of fit (Fanet al., 1999).

In this regard, some literature suggests other values, for example, Hu and Bentler (1999), suggest values ≤ 0,06; Schumacker and Lomax (2004) refer that it is equal to or less than 0,05 for a perfect fit, however, in the literature there are different proposals, which establish ranges of <0,10 as adequate adjustments (Yilmaz, 2018; Yalçiner et al., 2019). For our study, the RMSEA value (,054) is good. In support, the mean square error rate (RMR) of 0,071 indicates a good fit as it is closer to zero than one, which is a good indication that the variances and covariance's differ from the estimates obtained in the final model. Finally, the parsimony measures exceed the suggested theoretical threshold of 0,5 to 0,7 PRATIO (,762), PVFI (,681) and PCFI (,707).

4. Discussion

To answer the question and to know, how students perceive the savings and investment, income and money management, we obtained the follow result: As demonstrated in the final measurement model that show the best fit, the factor called Income$ represents the largest component. About Income$, they consider that the main source of income for students is provided by a part-time job, as well, the tax increase affects the stability of the companies and increases the instability of the employees. In addition, taking extracurricular training courses, in a job, results in earning more money because it is more valuable to their company. One of the main sources of income for adults between the ages of 20 and 35 are wages, salaries and tips. The amount paid in taxes is proportional to the salary received. This study is consistent with the previous work of García-Santillán (2020) in relation to the perspective of economic income, who reported as a favorable attitude towards taking care of personal finances in high school students. About Hypothesis, H1: There is a relationship between economic income and money management (> ,5), the final model show a significate relation between Income$ and Money management (0,82).

About the hypothesis H2: There is a relationship between saving-investment and money management (> ,5) the final model show a significate relation between saving-investment and Money management (0,75). The factor Money management, show how student perceive this variable. They refers that there is more life insurance coverage for women, also, the income obtained for transportation, clothing, telephone service, and footwear must be distributed. In addition, it is important to allocate an amount for savings from the income obtained, if possible from an early age when studying high school. It is convenient to manage the money since the insurance they currently receive comes from their parents and in the future, they will have to pay for it, otherwise if they are unemployed, they will have to suspend it. That is why the importance of money management, since priority is given to savings and health care insurance. In relation to insurance, the systematic and bibliometric study developed by Goyal and Kumar, (2020) report evidence of a significant gap in some aspects, including knowledge of insurance.

They also understand the issue of savings and investment, since they know the financial products and services offered by Financial Institutions in terms of investments. On the subject of savings, they consider that it is for emergencies, or for example, when they buy something, they take into account the lowest price to save something. In addition, they understand that investment funds are offers in financial institutions. Regarding financial knowledge, there are studies that have documented these findings on financial knowledge and how this favors formal and informal savings, retirement plans, pensions and insurance (Niu et al., 2020). Otherwise, studies have been documented that have explored financial behaviors, where low-income unemployed people lack financial knowledge (De Beckker et al., 2019), but not in people with a high educational level. , who show a high percentage of knowledge, financial behavior and financial attitudes. In addition, the existing gap between economies in transition and industrial economies has been reported, where the level of financial knowledge is different between them (Stolper, Walter, 2017). In these studies, age has been considered as a variable that has made a difference. In relation to older adults and low-income youth, they show low levels of financial literacy and, consequently, make financial mistakes more frequently.

5. Conclusion

Finally, each study contributes something important to be analyzed in its proper dimension. This work allowed us to know the financial knowledge that the students surveyed have, and how has favored the management of their personal finances. The findings on the subject of savings, the importance given to the subject of insurance, to name a few, are interesting, although these results differ from other studies carried out in other contexts in different study populations.

6. Future research

The results of the study allow us to identify the relationship between the variables economic income (Income$), savings-investment and money management. It is undoubtedly a logical relationship, since on the one hand there is income and on the other the option of saving or investing, the money management variable being the link of this relationship. However, other issues can be integrated into the construct analyzed in this work, for example, including the variables: budgets, insurance, pensions and Afores in the case of Mexico, which will allow us to build strategies to redesign the plans of study within educational institutions.

7. Ethics statement

This study was carried out in accordance with the recommendations of Code of Ethics of UCC Business School and Tecnológico Nacional de México. The Ethics Committee approved the protocol for Research, of the Division of Graduate Studies and Research. In accordance with the Declaration of Helsinki, all parents gave written informed consent for student' participation in the study.

8. Conflicts of interest

The author declare no conflict of interest.

9. Author contributions

The author has made a substantial, direct and intellectual contribution to the work, and approved it for publication.

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Appendix 1

Table 1. Item Total Statistics

	Mean of scale if item is deleted	Scale variance if item is deleted	Total item correlation corrected	Cronbach's alpha if item is deleted
Gender	147.5798	265.635	-.140	.746
Age	128.7714	260.476	.006	.750
CivilStatus	143.6874	253.488	.144	.742
LaborStatus	147.7613	265.068	-.097	.745
Income$$$	143.7361	257.861	-.014	.764
Medical Service	146.8134	267.381	-.119	.763
Family relationship	146.2252	269.491	-.159	.759
V1	147.2504	263.515	-.012	.744
V2	145.7176	244.822	.450	.727
V3	145.9261	244.382	.462	.727
V4	145.8874	245.417	.401	.729
V5	145.7176	244.449	.470	.727
V6	145.7513	251.036	.312	.734
V7	145.8723	258.798	.086	.743
V8	145.7597	254.166	.225	.737
V9	145.5294	246.317	.386	.730
V10	145.9445	252.780	.264	.736
V11	145.9395	250.596	.295	.734
V12	145.8706	252.345	.233	.737
V13	145.7395	246.728	.382	.730
V14	145.6723	250.025	.306	.734
V15	145.6034	246.011	.392	.729
V16	145.5193	244.523	.424	.728
V17	145.6504	247.888	.358	.731
V18	145.6420	246.725	.388	.730
V19	145.9664	251.511	.289	.735
V20	145.8252	249.239	.337	.732
V21	146.2571	258.747	.076	.744
V22	146.0891	251.566	.240	.737
V23	145.8773	249.677	.290	.734
V24	145.8891	250.728	.288	.735
V25	146.0521	254.656	.174	.740
V26	145.9529	251.334	.280	.735
V27	145.9227	248.573	.364	.731
V28	145.8773	251.219	.303	.734
V29	145.8992	250.862	.301	.734
V30	145.8555	251.208	.294	.734
V31	145.7496	250.279	.293	.734
V32	145.9782	252.893	.237	.737
V33	146.3311	257.686	.106	.743
V34	146.3277	255.268	.162	.740
V35	146.2689	251.507	.273	.735

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Education Program on Physics and Chemistry for Non-Equilibrium Processes at the Interfaces between Solid-Liquid-Gaseous Media

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Abstract

The training on Non-equilibrium processes in allocated areas in physics was primarily developed by Anton Antonov (1934–2021) from 1984–2011. During this time, physics students at the South-West University "Neofit Rilski" in Blagoevgrad were trained.

Oleg Mosin (1966–2016) at Moscow State University of Applied Biotechnology performed the education with a nonequilibrium process in physics and chemistry.

The authors participated in a program for laboratory experiments on non-equilibrium processes. The processes are at the interfaces between solid-liquid-gaseous media. They also participated in scientific research and analysis of non-equilibrium processes under various natural and laboratory conditions. In the laboratory, conditions were created models near to natural environmental conditions.

There are two main directions of study. The first direction involves the analysis of laboratory effects in corona gas discharge at the interfaces of air-solid surface and air-liquid medium-solid surface. The photographic registration method used is called electrophotography. Antonov and co-authors obtained electrophotographic images using a polymerized methacrylate film on a metal substrate rather than a photographic film.

In the second direction, the analysis focuses on the discrete evaporation of water droplets placed on a solid surface inside a hermetic air chamber. The restructuring of hydrogen bonds between water molecules is analyzed.

The obtained spectra are called the Non-equilibrium Energy Spectrum (NES) and the Differential Non-equilibrium Energy Spectrum (DNES).

In the second direction, analyses are conducted using test samples and control samples.

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During the training, students acquire skills in analyzing non-equilibrium media in air-liquid medium-solid surface systems using methods such as infrared spectroscopic analysis, statistical analysis, measurement of electrical parameters of liquids, pH, and oxidation-reduction potential (ORP). Electrochemical studies are conducted on various types of water in accordance with Ordinance No. 9/2001, Official State Gazette, issue 30, and decree No. 178/23.07.2004 of Council of Ministers, Bulgaria, about the quality of water, intended for drinking and household purposes.

Keywords: education, physics, Bulgaria, electrical processes, water, electric parameters.

1. Introduction

In nature, there are ongoing non-equilibrium processes at the boundaries between solid-liquid-gaseous media (Holzbecher, 2016; Heinze, Bloecher, 2019; Ignatov et al., 2023). Many of these processes involve reactions with polar molecules (Roduner, Radhakrishnan, 2016). In the physics and biophysics training program, the study of effects in non-equilibrium systems is achieved by examining samples and control samples.

Particularly valuable are the studies and analyses related to processes at boundary media concerning carbon emissions and global warming. Calcium carbonate ($CaCO_3$) undergoes processes influenced by natural factors such as temperature, humidity, and phase transitions. The possible process for the origin of life was described for water with calcium carbonate, Rupite, Bulgaria (Ignatov, 1999).

The Differential Non-equilibrium Energy Spectrum (DNES) is a method with studies in carbon emissions and global warming used to assess the structural changes in water resulting from environmental influences. This method assumes that factors other than the one under examination have an identical combined influence on the control and the analyzed sample. The NES and DNES spectral studies cover a range of wavelengths (λ) from 8 to 14 μm and wave numbers ($\tilde{\nu}$) from 1250 to 714 cm^{-1}. Within this range, the absorption and reflection of water exhibit the highest degree of polarization of infrared radiation, typically ranging from approximately 4 % to 10 % (Shaw, 1999).

To evaluate non-equilibrium conditions involving $CaCO_3$, several factors were analyzed, including the effects of cave water (Antonov, 1995), gas-solid heat exchange (Galvan, Hernandez, 2009), the development of CO_2 capture technologies, and the utilization of strategies to reduce anthropogenic emissions as part of solutions to combat climate change), and global dioxide emissions (Ozekmekci, Copur, 2021).

NES and DNES spectroscopy indicate changes in water structure resulting from an impact, assuming that the overall influence of all other factors except the examined impact is the same for the control and sample samples (Antonov, 1995).

NES and DNES methods are used for studies under dynamic natural conditions, such as water phase transitions (Todorov et al., 2010), solar eclipses (Ignatov et al., 2023), and mountain (Todorov et al., 2008; Boteva et al., 2013), glacier (Ignatov, Valcheva, 2023), mineral (Ignatov et al., 2021), and sea waters (Mehandjiev et al., 2023).

The Bulgarian scientist Nadjakov discovered sulfur photoconduction effects in 1937 and published a paper for photoelectrets. The practical application of photoelectrets is a photocopier. A few years later, Carlson developed electrophotographic copying called xerography.

In 1961 Antonov and Zadorozhniy researched with Nadjakov on the polarization effects of photoelectrets (Nadjakov et al., 1961).

In 1930, Carlson invented electrophotographic copying, which is called xerography.

Since 1960 Fridkin, Golovin, Antonov, and co-authors developed electrophotographic methods to register images (Golovin et al., 1960). Fridkin is recognized as the inventor of xerography in the former USSR.

Students are introduced to various image registration methods of coronal gas discharge laboratory conditions. The method was categorized as an electrophotographic method. There were calculations with a low of Schaffert (Schaffert et al., 1965)

The training methodology includes laboratory exercises, and the obtained experimental results are analyzed.

The training aims to enhance the student's creative process in developing working hypotheses, reference analyses, construction of laboratory experiments, analysis of results, and practical applications.

The authors educate the laboratory results and analyses in Bulgarian and English with methodology development (Ramankulov et al., 2019).

Q-methodology, a reliable method that takes individuals' unique perspectives, was employed to determine students' opinions and perceptions (Servet, 2016).

One of the co-authors, Ignatov, performed training with students in secondary schools in Teteven municipality, Bulgaria, with practices for the research of mountain water and digital methods (Soboleva, Karabaev, 2020; Soboleva et al., 2020).

In the modern world, the improvement of the methods for online education is necessary. The online learning environment by changing the students' behavior improves the quality of the education process (Delen, Liew, 2016).

Water processes in the environment are an object of education.

University students' education was applied to mobile phones (Valeeva et al., 2019).

The basic aim is to make connections for practical applications of the knowledge from physics and chemistry for the processes in the environment for clean water, global warming, and processes of the interfaces between solid-liquid-gaseous media. Especially the students have also qualifications for non-equilibrium processes with application in ecology.

2. Materials and methods

2.1. Educational practices and specializations

During the training, network modeling is also applied. Interdisciplinary dependencies are established between results and analyses in the natural sciences (Ignatov, 1989; Traxler, 2022).

The municipality of Teteven, Bulgaria, and Ignatov are co-organizers of the event with training "Days of Mountain Water". The event has been organized since 2010, each year on June 11th. (Athanasiadis et al., 2023)

Gramatikov is author of book Physics, South-West University "Neofit Rilski", Blagoevgrad.

Gramatikov participates in the project: Joint supervision of Ph.D. students in Physics.

Supervisor: Kanapia M. Arangazin (Kazakh State University, Kazakhstan) and Plamen Gramatikov (Neofit Rilski South-West University-Blagoevgrad).

Funding organization: Karaganda State University "E.A. Buketov" (KSU), Kazakhstan.

Period: 2014–2019.

Iliev takes part in educational project BG051PO001-3.3.07-0001 "SCHOOL PRACTICE" with the financial support of the Operational Program "Development of Human Resources", financed by the European Social Fund of the European Union, a project of the Ministry of Education and Science – Bulgaria:

2.2. Device for spectral analyses with methods NES and DNES

The energy (E) of hydrogen bonds among H_2O molecules in water samples is measured in eV. The function f(E) is called the energy distribution spectrum. A non-equilibrium evaporation process of water droplets characterizes the energy spectrum of water. This non-equilibrium energy spectrum (NES) is measured in eV^{-1}. DNES is defined as the difference:

$$\Delta f(E)=f(\text{water sample}) - f(\text{control sample}) \quad (1)$$

DNES is measured in eV^{-1} where f (*) denotes the evaluated energy.

The scheme of the device is shown in Figure 2.

The wetting angle θ was measured with a specially designed instrument which is described in detail (Antonov, 1995; Todorova, Antonov, 2000). Evaporation of water drops was performed in a sealed chamber with a stable temperature of 22°C and humidity of 65-70 % (Figure 1). The drops were placed on a 350 μm thick BoPET (biaxially-oriented polyethylene terephthalate) sheet.

The wetting angle θ is a function of a and d_1.

The device has the following technical features:

- Monochromatic filter with wavelength λ = 580 ± 7 nm;
- Water evaporation angle ranging from 72.3 deg to 0 deg.

Measured range of energy of hydrogen bonds among water molecules is λ = 8.9 ÷13.8 μm or E = (-0.08) ÷ (-0.1387) eV.

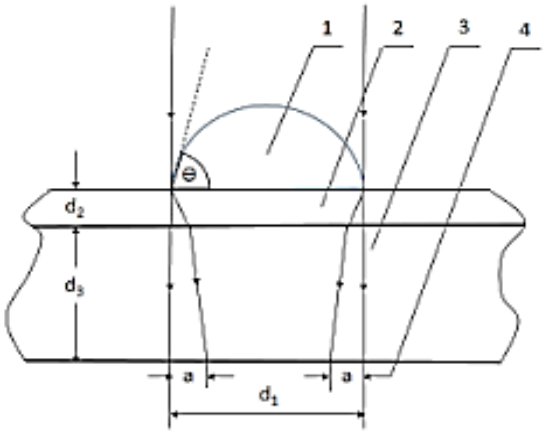

Fig. 1. Operating principle of the method for measuring the wetting angle of liquid drops on a hard surface: 1 – drop, 2 – thin Maylar sheet, 3 – glass plate, 4 – refraction ring width

2.3. Device for electrophotographic registration with device for coronal electric discharge

An extensive investigation was conducted on gas discharge emission for color coronal spectra within a controlled dark room environment. The emission was captured using photosensitive paper or color film, carefully positioned on a transparent Hostaphan electrode with a diameter of 87 mm. The electrode was filled with a conductive liquid comprising a 1 % NaCl solution in deionized water. Pulses with 12 kV voltage and a carrier frequency of 15 kHz were applied between the objects and the electrode copper coating.

Figure 2 shows the scheme of the device.

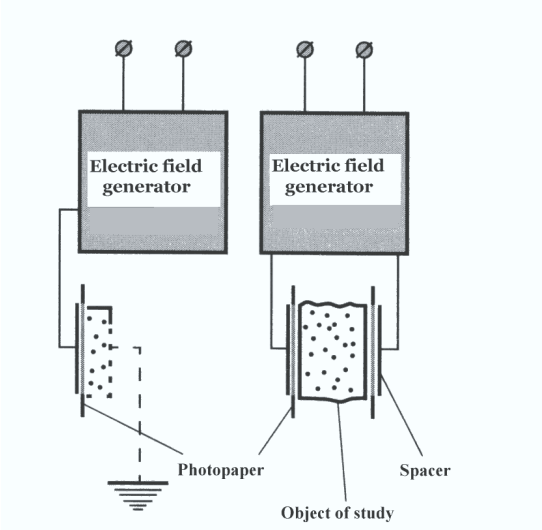

Fig. 2. Functional scheme of the gas corona discharge device

A corona gas discharge was produced within the gap between the investigated objects and the transparent electrode, resulting in a distinct glow surrounding the contact area. This discharge emitted electromagnetic waves within the wavelength ranges of 380–495 and 570–750±5 nm, which illuminated the respective photosensitive material based on the specific properties of the objects.

2.4. Statistical analyses

Statistical analyses are performed based on the working hypothesis and the available data. Student's t-test and Mann-Whitney U test are commonly applied. Students are trained to create computer programs for conducting t-tests.

3. Discussion

During the training on non-equilibrium processes between boundary media, air-water-solid or air-land, students acquire the following skills:

1. A complementary approach to scientific and applied physics, chemistry, biology, and medicine activities.
2. Knowledge of processes in non-equilibrium boundary media such as air-water-solid or air-land enables successful work in ecology.
3. Analyses of boundary media processes are particularly valuable for carbon emissions and global warming activities.
4. Spectral methods for studying water and its physicochemical composition are applicable in investigating acid rain and water filtration possibilities.
5. Conduct experiments and analyses of methods for alternative energy sources such as solar panels, osmosis diffusion, and batteries.
6. Experiments with electrophotography using corona discharge allow for image analysis skills. One of the collaborators, Iliev, works with a 3D printer to obtain images (Dankov et al., 2023).
7. Analyzing data from laboratory exercises enables work in scientific institutes and production companies.
8. Skills in structuring and implementing scientific-applied projects are acquired.
9. Skills in innovation, organization, and meeting deadlines for teamwork are developed.

4. Results

Training Program for Non-Equilibrium Processes

4.1. Measurement of IR Spectra of Water Using NES and DNES Methods

Measurements are conducted on samples and control samples of water and 1 % solutions of inorganic compounds and natural waters (Gramatikov et al., 1992, Todorov et al., 2008; Mehandjiev et al., 2023). The studies were made for medicinal plants (Ignatov et al., 2022). Students and doctoral students perform analyses as follows:

Using the NES method, analyses are conducted on various types of water-tap, mountain spring water, glacier water, mineral, and seawater.

The parameters after filtration with zeolite (Popova et al., 2022) and shungite (Ignatov et al., 2022) were studied.

The training shows the sizes of non-organic chemical particles. The size of the water molecule is 0.27 nm.

Analyses are performed based on the physicochemical composition of peaks in the NES spectra.

Calculations are made using Oxidation-Reduction Potential (ORP) and pH formulas to determine the presence of free electrons, positive ions, H^+ ions, and hydroxyl groups (OH^-).

A comprehensive analysis of the properties of the examined waters is conducted.

When studying with filtering systems, analyses are conducted using the DNES method on control samples before and after filtration. DNES is obtained by comparing the NES of samples and control samples. Statistical analysis demonstrates the reliability of the results.

The analysis is performed on the energy distribution between hydrogen bonds in water molecules.

Luck considers that in water, hydrogen bonds exist between one water molecule's hydrogen atom and another's (Luck, 1980). Most of them are bound by the energy of the connection (-E), and the remaining are free (E = 0). It is accepted that E has a negative value. This is known as Luck's two-state model.

A model was described with the Gaussian distribution of water molecules in clusters. This model corresponds with the results with NES and DNES spectrums (Mehandjiev et al., 2022).

The students have a task to make analyses with Gaussian distribution of the behavior of water molecules and estimation of the size of water clusters. The size of a dodecahedral cluster with 21 water molecules is 0.822 nm (Ignatov et al., 2021).

4.2. Electrophotographic Registration

The following directions are in the studies with electrophotographic registration.

1. Electrophotographic methods for image registration.
2. Fundamental schemes of xerography and the development of xerographic methods.
3. Antonov's experiments with electrophotography and electrographic copying of images.

4. Parameters of photographic films in corona discharge. Registration with black-and-white photographic films (Antonov, Yuskesselieva, 1968; Ignatov et al., 1998). Registration with color photographic films (Ignatov, 2007).

The coronal gas discharge effect (Pehek, 1976) is connected with dielectric permittivity, not electric conductivity (Antonov, 1995). The wavelength ranges for color coronal gas discharge effects are 380–495 and 570–750±5 nm (Ignatov et al., 2021; Ignatov et al., 2025)

4.3. Comprehensive Application of Electrophotographic Methods and Spectral Analyses using NES and DNES, pH, ORP, and Conductivity in Water and Solution Studies

During the training, investigations are conducted on water samples due to the applied treatment and control samples. The following calculations are performed for both samples: the wavelength λ in nm, the energy of the emitted photons E in eV, and the photon emission per cm2 from the water droplet base. The students are tasked with calculating the effective power of the electrical parameters for obtaining photon emission from the water droplet. The difference between the sample and the control sample provides information about the dielectric permeability. Electrical conductivity is measured in μS/cm, oxidation-reduction potential (ORP) in mV, and pH.

The statistical Mann-Whitney U test is applied for smaller measurements, while the t-test of Student is used for a more significant number.

One of the co-authors, Iliev, developed in the Faculty of Physics, Sofia University methods for the research of dialectical parameters (Iliev et al., 2012, Koduru et al., 2016).

4.4. Training for the process with calcium carbonate of global warming

The following reaction is valid:

$2HCO_3^- + Ca^{2+} \rightarrow CaCO_3 + CO_2 + H_2O$ (2)

The lime cycle is

$CaCO_3 \rightarrow CaO \rightarrow Ca(OH)_2 \rightarrow CaCO_3$ (3)

The chemical reaction (2) is a significant emitter of global dioxide emissions (Bian et al., 2022).

With the research of 713 and in the range 873 ÷ 879 cm^{-1} is possible to estimate the influence on the environment and select the optimal value for the industry.

Developing CO_2 capture and using technologies to reduce anthropogenic emissions can be part of the solution against climate change (Ozekmekci, Copur, 2021).

4.5. Visualization of the Gaussian distribution and mathematical modeling of hydrogen bonds between water molecules and structuring of clusters

The authors create with spectral methods NES and DNES mathematical models of clusters of water molecules (Ignatov, Mosin, 2014; Ignatov et al., 2021). Also, the cluster calculation was performed with the model of the Gaussian distribution of water molecules (Mehandjiev et al., 2022).

The visualization of the structuring of water molecules makes education more attractive and visible for the students.

For the period 2013-2023, 82 students were tested. The main questions were:

1. Estimate the mathematical models of water molecules with tables.
2. Estimate the mathematical models with figures.

Table 1 illustrates the results with models of water molecules.

Table 1. Questions for the education with models of water molecules

Which model is more understated for you?		
With tables	7	8.5 %
With figures	75	91.5 %

The results are similar to the results of the visualization method (Fuchova, Korenova, 2019) for the parts of the human brain.

The results with visualization are more extensive than 90 %.

The education with visualization is for the processes which are not directly visible with the human visual analyzer.

Table 2 shows the distribution of numbers of water molecules according to the energy of hydrogen bonds per each 100 water molecules in the bulk volume of water after the electrolysis process and control water (Ignatov et al., 2021)

Table 2. Distribution of numbers of water molecules according to the energy of hydrogen bonds per each 100 water molecules in the bulk volume of water after the electrolysis process and control water

-E(eV)	Water sample	Control water sample	-E(eV)	Water sample	Control water sample
0.0937	0	8	0.1187	0	5
0.0962	0	6	0.1212	9	2
0.0987	0	2	0.1237	0	7
0.1012	1	4	0.1262	9	2
0.1037	10	4	0.1287	11	5
0.1062	4	4	0.1312	11	7
0.1087	3	10	0.1337	0	8
0.1112	4	6	0.1362	10	1
0.1137	6	9	0.1387	20	2
0.1162	2	8	–	–	–

Figure 3 shows the dodecahedral cluster with 20 water molecules at E=-0.1387 eV; (λ = 8.95 μm); ($\tilde{\nu}$ = 1117 cm^{-1}) (Ignatov et al., 2021)

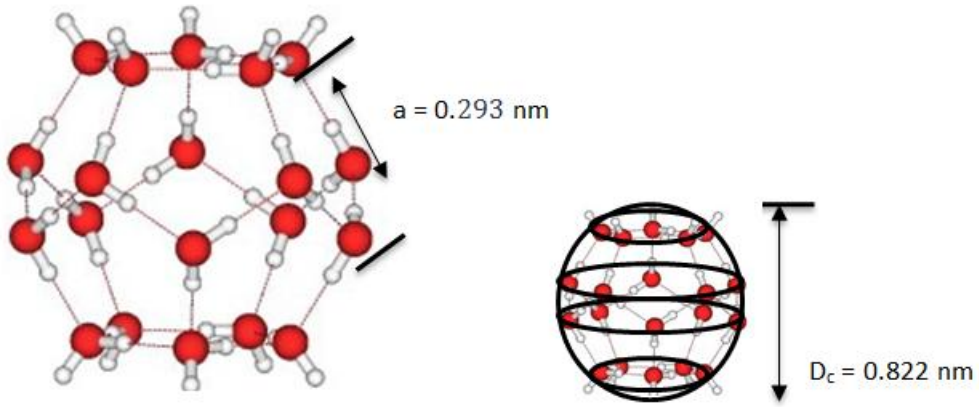

Fig. 3. Dodecahedral cluster with 20 water molecules at E=-0.1387 eV(λ = 8.95 μm)($\tilde{\nu}$ = 1117 cm^{-1})

In 2013 Ignatov and Mosin published the life spans of water molecules and clusters. The achievement was cited in 2021 in the journal Scientific Reports (Nature Publishing Group) from (Gao, Fang, Ni, 2021). Water clusters are short-lived and flickering, with life spans estimated from 10^{-10} to 10^{-11} s and water molecules of 10^{-10} to 10^{-11} s.

The new calculations are connected with the Gaussian distribution of water molecules.

4. 6. Visualization of corona gas discharge effects with electrography

The research was done with electrophotographic registration of water drops from tap water in Sofia, Bulgaria (Ignatov, 2007). The results are connected with dielectric permittivity. Figure 4 illustrates the coronal electric effect or water drop from tap water.

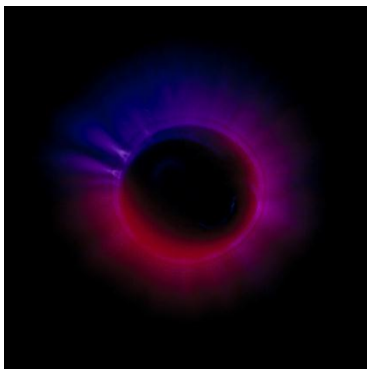

Fig. 4. Coronal electric effect or water drop from tap water

For the period 2013–2023, 82 students were tested.

The average results in the coronal electric discharge are – red (1.82), blue (2.64), and violet color (3.03) eV.

The main questions were:

1. Estimate the photon emission of corona electric effects of water drops from the tables with the values of the colors.
2. Estimate of photon emission of corona electric effects with results from water drops.

Table 3 illustrates the results.

Table 3. Questions for education with models of coronal electric emission

Which model is more understated for you?		
With tables	3	3.7 %
With images	79	96.3 %

4.7. Visualization of electrical parameters of water with osmosis diffusion between sea and river waters.

The experiments were performed with a device for osmosis and diffusion. The patented ceramic element is with sea water or a solution of NaCl, and the Becher glass is with river water or deionized water (Mehandjiev et al., 2023) (Figure 5).

The direction of osmosis is from the Becher glass to the ceramic element. The direction of the diffusion is from the ceramic element.

The electric current results from the electrical charges – Na^+, H^+, Cl^- ions.

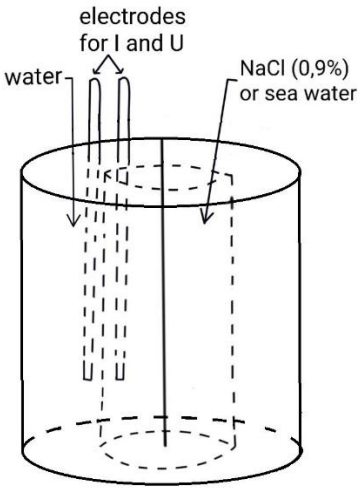

Fig. 5. Device for osmosis/diffusion

The main questions were:

1. Estimate the electrical process in osmosis/diffusion from the tables with the values of the colors.
2. Estimate of the electrical process in osmosis/diffusion from laboratory device.

Table 4 illustrates the results

Table 4. Questions for the education with process in osmosis/diffusion

Which model is more understated for you?		
With tables	9	11.0 %
With images	73	89.0 %

Mann-Whitney U test was applied with the results from Tables 1, 3, and 4.

The results of group A are: 7, 3, 9.

The results of group B are: 75, 79, 73.

Based on the calculated U values:

$U_1 = 9$ for Group A.

$U_2 = 0$ for Group B.

Since U1 is more significant than U2 ($9 > 0$), it indicates that Group A has a higher rank sum than Group B. However, we need to know the critical U value or the significance level to determine whether this difference is statistically significant or due to random chance.

In summary, the Mann-Whitney U test results suggest that Group A has a higher rank sum than Group B.

The Mann-Whitney U test revealed a statistically significant difference between Group A and Group B ($p < 0.001$).

Education in physics and chemistry is complementary (Rodach et al., 2018; Gruzina et al., 2020) and has different applications and natural sciences, industry, sport, agriculture, and veterinary medicine. This education develops statistical methods for comparing different scientific results (Sidorov et al., 2018). One of the applications is modeling the water processes with acid rain (Popova et al., 2019).

5. Conclusion

Antonov created a training program on non-equilibrium processes in physics from 1984 to 2011. The program aimed to train physics students at the South-West University "Neofit Rilski" in Blagoevgrad. The program with students included laboratory experiments and scientific research on non-equilibrium processes at the interfaces of solid-liquid-gaseous media. Two main directions of study were pursued. The first involved the analysis of corona gas discharge effects at the interfaces of air-solid surface and air-liquid medium-solid surface using electrophotography. The second direction focused on the discrete evaporation of water droplets on a solid surface within a hermetic air chamber, analyzing the restructuring of hydrogen bonds between water molecules. Spectral studies used Non-equilibrium energy spectrum (NES) and Differential non-equilibrium energy spectrum (DNES) methods. The training also covered interdisciplinary dependencies in the natural sciences – physics, chemistry, biology, and medicine. They gained knowledge of processes in non-equilibrium boundary media, allowing for work in ecology. Analyses of boundary media processes were particularly valuable for carbon emissions and global warming studies. Various methods, such as infrared spectroscopic analysis, statistical analysis, and measurement of electrical parameters, pH, and oxidation-reduction potential (ORP), were used to analyze non-equilibrium media in air-liquid medium-solid surface systems. The training emphasized the importance of analyzing water's physicochemical composition for studies on acid rain, water filtration, and other applications. Students conducted experiments and analyses on alternative energy sources like solar panels, osmosis diffusion, and batteries. They also gained image analysis skills through electrophotography experiments using corona discharge and explored data analysis in laboratory exercises.

In conclusion, the training program on non-equilibrium processes fostered students' abilities in scientific analysis, interdisciplinary thinking, and practical applications. The comprehensive approach enabled them to understand and address complex phenomena related to non-equilibrium processes in various media. The acquired skills and knowledge are applied to scientific institutes, production companies, and environmental research. The training program provided a foundation for innovative

and collaborative work, encouraging students to contribute to scientific advancements and address contemporary challenges, including climate change and environmental sustainability.

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7. Competing interests
The authors declare no competing interests.

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Retrospective Analysis and Features of the Dynamics of Main Indicators in Training of Higher Qualification Personnel

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Abstract

Innovative development is a key factor in the technological sovereignty and competitiveness of the Russian economy on a global scale, especially in the face of sanctions pressure from unfriendly states. A critical resource that defines competitive advantage in the modern world is knowledge, the central role in the formation of which is held by human capital. Workers with higher education are the foundation of human capital relied upon by the innovation economy, fundamental and applied scientific research, and research and technological development. The study of quantitative and qualitative dynamics in the provision of higher qualification staff allows for assessing the innovative potential of the national economy, which determines the relevance of this direction of research. The established objective is fulfilled in the study through a review of statistical indicators characterizing the training of higher qualification personnel in Russia. With the use of mathematical and statistical methods, analysis, synthesis and descriptive methods, a retrospective analysis of the dynamics of basic indicators has been carried out that have a direct impact on the innovative potential of the Russian economy. The connection was evaluated between innovative processes and the personnel support of the research sector.

The study reveals that despite some qualitative success in recent years, there is a slight overall decline in the quantitative characteristics of higher qualification staff training, which negatively affects the intellectual capital of the country as a whole and reduces opportunities in the innovative development of the economy. This can impair the country's intellectual capital overall and reduce opportunities for research and development and the implementation of new technology in the economy. The retrospective analysis also confirms the detrimental impact of the higher education system reform from the point of existing qualitative statistical indicators.

Keywords: postgraduate studies, doctoral studies, innovative development, intellectual capital, retrospective analysis, human capital.

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1. Introduction

Higher qualification personnel are a critical link in the training and provision of staff for the national science, higher school, and strategic sectors of the economy (Kelsina, 2018; Malichenko, 2019). The innovative development policy is primarily driven by research work and personnel capable of generating new ideas in this field (Latkin, Trotsenko, 2020). In other words, the availability of enough people able to generate new ideas and invent new technology is a vital precondition for the innovative development of the economy (Gurtov i dr., 2022; Terent'ev i dr., 2018). For this reason, the study of primary statistical indicators of personnel training in higher education is a topical research task (Argilov, 2022; Kuvshinov, Chempalova, 2019).

In existing studies, as a rule, the authors turn to either only one characteristic of the functioning of the training of high school personnel (number of graduates), or use static data for individual years as an illustration of ongoing processes in the field of higher education. Also, researchers in their works do not conduct assessments of the influence of the dynamics of indicators of the training system of higher education on the indicators of innovative activities in the economy. In the presented article, these deficiencies will be eliminated.

The established system of training of higher qualification personnel remained principally unchanged for decades in the time of the USSR, serving as a fundamental and stable source of scientific and pedagogical personnel for the national economy. However, after the collapse of the Soviet Union, the prestige and quality of postgraduate education dropped (Bednii i dr., 2017; Mironenko, 2018). In particular, N.I. Bednyi points to a fact specific to Russia – a sharp rise in the number of postgraduate students against the decline of scientific personnel. This suggests a logical conclusion that the association between postgraduate education and success in research and development (R&D). The researcher notes that trends in the development of the postgraduate and scientific research sectors turned out to diverge (Bednii, Ribakov, 2022). Despite some positive changes in this sphere, the ratio of postgraduate students to professional researchers is still far even from that in the mid-1990s. Although the number of postgraduate students has declined significantly since 2010, it remains higher than that of researchers, which has been consistently reducing since 1992 (Bednii, Ribakov, 2022). Here we should clarify that between 2000 and 2021, with an overall decline in the number of R&D staff, the number of persons with secondary vocational or other education had decreased by a factor of 2 or more. In turn, the number of researchers with higher education has hardly changed in 20 years (Vlasova i dr., 2023).

Thus, despite the rising number of higher education graduates, the level of Russian science, including on the world scale, remained rather low since the 1990s and could not serve as a basis for technological breakthroughs in the economy (Barabash i dr., 2017). This fact has entailed a series of successive changes to the system of training of scientific and pedagogical staff in the past decade (Latkin, Trotsenko, 2020). The results of these reforms are rather ambiguously interpreted by Russian researchers (Bednii, Ribakov, 2022; Kapshutar, 2016; Krasinskaya, Klimova, 2020). Stricter requirements of the Higher Attestation Commission have led to negative trends in the form of quantitative and qualitative decline in the indicators of training of senior professionals (Vellem, 2023; Martinova i dr., 2019; Senchenko, 2015). In particular, one of the bases for criticism of the training system is the low share of postgraduates defending dissertations (Terent'ev i dr., 2018; Afanasev i dr., 2023; Zerchaninova, Tarbeeva, 2019). The ongoing changes have not yet shown significant improvement in this matter. On the one hand, the reforms were intended to improve the quality of dissertations (Pahomov i dr., 2019), which is the exact reason for the lower number of successful defenses among the graduates of postgraduate and doctoral programs (Ignat'ev, 2021). However, this has resulted in a larger gap between Russia and developed countries in the relative share of postgraduate students in the total population, which was already quite low before (Bednii, Ribakov, 2022).

2. Methods

To perform a retrospective assessment of the dynamics of main indicators of higher qualification personnel training in Russia, the study uses data provided by Rosstat (Federal'naya sluzhba...; Obrazovanie v Rossii..., 2003; Rossiiskii statisticheskii ezhegodnik..., 1996) and the Higher School of Economics (Vlasova i dr., 2023). To process the presented data arrays, a descriptive method, mathematical and statistical methods, analysis and synthesis were used. For the most complete and objective presentation of the results obtained, graphical and tabular methods were utilized.

Highly qualified personnel include persons who have mastered the third level of higher education, and who subsequently, having received an academic degree, are engaged in teaching and research activities. The most important indicator of the functioning of the institute of higher education is the number of researchers with academic degrees, since they play a key role in shaping innovation processes in the economy, so the first part of the current work is devoted to a retrospective study of the dynamics of the number of researchers.

The key parameters of the functioning of the system of higher qualification personnel training are data on their number and admission to and graduation from postgraduate and doctoral programs, as well as the structure of graduates by the main branches of science. The second part of this article is devoted to the study of the dynamics of these statistical indicators.

3. Discussion

The uncontrollable explosive rise of the primary indicators of higher qualification personnel training in the 1990s and 2000s was not accompanied by a greater quality of work in Russian science and education. On the contrary, this increase resulted in the fall of the prestige of academic degrees among the general public. This effect was also aggravated by the widespread plagiarism and diminished scientific value of dissertations. In part, these problems have survived to this day (Mironenko, 2018), although considerable work has been carried out in the past decade to reform the postgraduate education system to improve the quality of training of higher qualification personnel.

Unfortunately, the ongoing changes cannot be considered entirely positive, since against the background of a slight increase in the relative proportion of dissertation defenses, there has been a precipitous drop in the number of postgraduate and doctoral students enrolled and graduating. Other statistical indicators that would allow us to track changes in qualitative indicators (e.g., the scientific value of candidate and doctoral dissertations) are not provided. This fact greatly complicates the objective assessment of the ongoing transformation of higher education.

It is worth noting that the results of reforms are more noticeable in the results of doctoral studies: in this area, the share of graduates with defended dissertations has increased dramatically since 2017 and has almost reached the indicators of the mid-1990s. The number of doctoral students has now decreased fivefold compared to its peak in 2013. Reduction is observed in the number of those entering and completing doctoral studies (Bychkova, Timoshenko, 2018). To somewhat paraphrase E.A. Terent'ev (Terent'ev i dr., 2018), this will eventually entail the lack of a “critical mass of people with higher qualification”, the latter being a critical precondition for the global competitiveness of Russia. The average age of researchers with a doctoral degree has risen from 60 to 64 between 2000 and 2021 (Vlasova i dr., 2023). The sharp drop in the number of doctoral graduates will cause further increases in the average age of researchers with higher academic degrees. This fact cannot but raise justified concerns about the future of Russian science. At the same time, it should be noted the "overflow" of scientific personnel from natural and technical fields into the humanitarian and public scientific sphere, which negatively affected the indicators of innovation activity in the Russian industry.

4. Results

The training of higher qualification personnel describes the work of postgraduate and doctoral schools: admission and graduation, as well as the number of postgraduate students and doctors. The dynamics of these primary indicators allow assessing prospects for the development of Russian higher education relying both on current data and retrospective analysis of statistical indicators.

As mentioned above, one of the factors in the competitiveness of Russia in the global knowledge economy is the availability of enough people with higher qualifications (Terent'ev i dr., 2018). Here we refer to researchers with the academic degrees of candidates and doctors of science. Thus, the starting point for the study is data on the dynamics of the factual amount of researchers in the past decades, which are illustrated in Figure 1.

Figure 1 shows that since 1990, there has been a continuous downward trend in the number of workers directly engaged in scientific R&D. The period of the most dramatic decline was in the first half of the 1990s. After that, the reduction of staff has been gradually slowing down, although it has preserved its negative nature up to the present day.

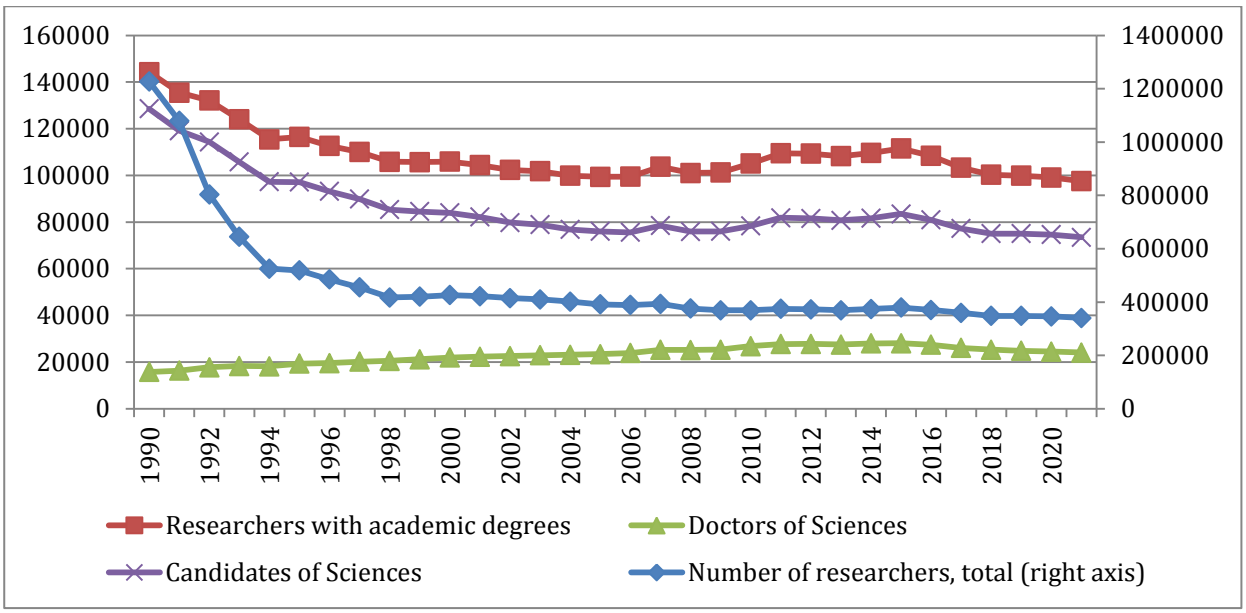

Fig. 1. Dynamics of the number of researchers, including those with academic degrees, persons (Source: compiled by the author according to (Vlasova i dr., 2023a; Federal'naya sluzhba...; Obrazovanie v Rossii..., 2003; Rossiiskii statisticheskii ezhegodnik..., 1996)

In the second half of the 2010s, the reduction of research personnel with degrees began, which had a negative impact on the innovative development of the country, primarily in the industrial sector. These processes are illustrated in Figure 2.

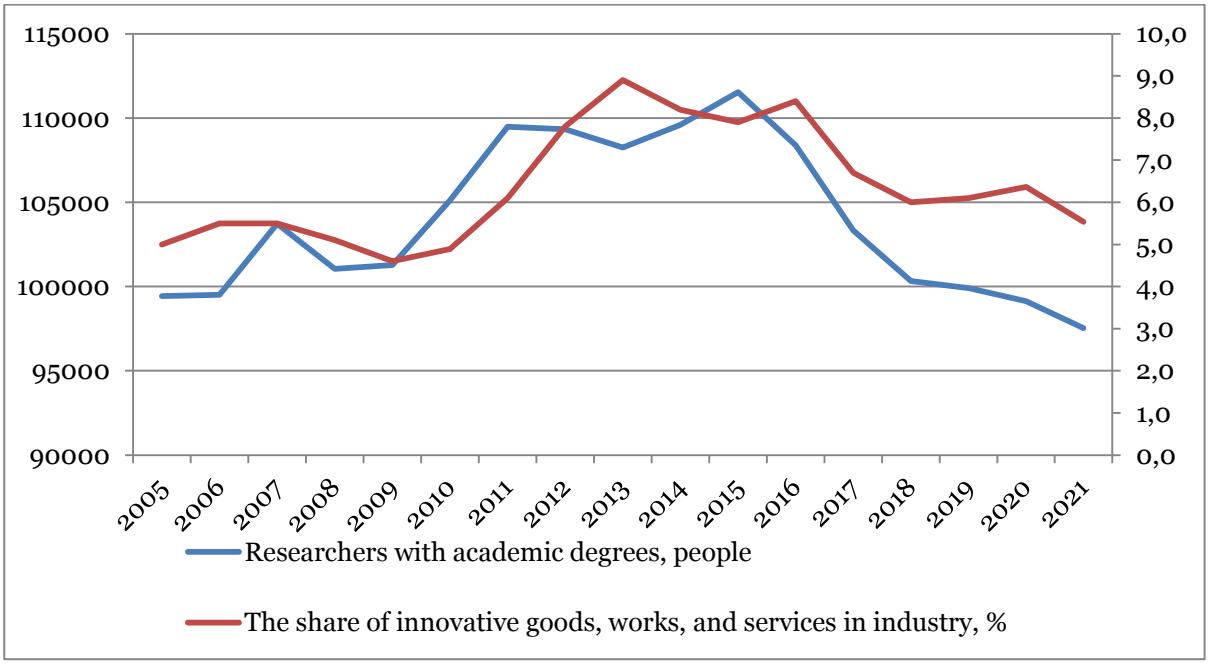

Fig. 2. Dynamics of the number of researchers, including those with academic degrees, people (Federal'naya sluzhba...)

As can be seen from Figure 2, there is a similarity in the dynamics between the change in the number of researchers and the share of innovative products in the industry. Therefore, we can confidently say that the lack of an innovative breakthrough in the Russian economy is largely due to the shortage of research personnel, which is clearly demonstrated to us in Figure 2.

S.V. Istomina also in her work, along with other active factors, established a regression relationship between the share of innovative products and the share of researchers with an

academic degree (Istomina i dr., 2018). However, it is worth checking out a similar dependence not only on the relative proportion of researchers with degrees, but also on their absolute number, since, as we said above, to ensure the competitiveness of the domestic economy, a "critical mass of highly qualified people" is needed. In addition, it is worth noting that S.V. Istomina operates only with the period 2006–2015, which reduces the reliability of the regression equation obtained by her due to the limited sample. In the current work, the period 2005–2021 is considered with a large number of observations (17 vs. 10), which increases the reliability of the correlation analysis. Of course, Figure 2 is not enough for a confident conclusion about the correlation of indicators. Let's move on to estimates by statistical methods.

The equation of paired linear regression of the dependence of the share of innovative products in industry on the absolute number of researchers with scientific degrees for the period 2005–2021 is as follows:

$$Y = 88309{,}686+2446{,}1449X, \text{ where}$$

Y – the share of innovative goods, works and services in industry;

X – number of researchers with scientific degrees.

The correlation coefficient is 0.724, the coefficient of determination is 0.525. The significance of F and the P-value of the variable X take values of 0.001 (with the actual value of the Fisher criterion of 16.56 and the tabular value of 4.54), which indicates a sufficiently high reliability and statistical significance of the obtained regression model. Thus, an increase in the number of researchers with scientific degrees by 2,446 people leads to an increase in the share of innovative goods, works and services in the industrial sector by 1 %.

The data obtained indicate a high dependence of innovation processes in the industrial sector on the dynamics of the number of researchers. And that a qualitative innovation breakthrough in the Russian economy should be based, first of all, on scientific personnel. Now let's move on to the assessment of the structural dynamics of changes in the number of higher school personnel.

It is worth noting that the number of researchers with academic degrees has reduced relatively little and has been roughly constant since the mid-2000s – this has a consequence in the stagnation of the share of innovative products. This reduction, however, affected primarily workers with candidate degrees. In contrast, the number of doctoral candidates in academia has had a marked increase over the past 30 years, contrary to the trend observed among researchers. While in 1990, there were 15,739 researchers with doctoral degrees, by 2021 there were only 24,074, with 128,547 and 73,463 candidates, respectively. To estimate relative indicators, the share of doctors of sciences has grown 5.5 times, and the proportion of candidates – 2.1 times (Figure 3).

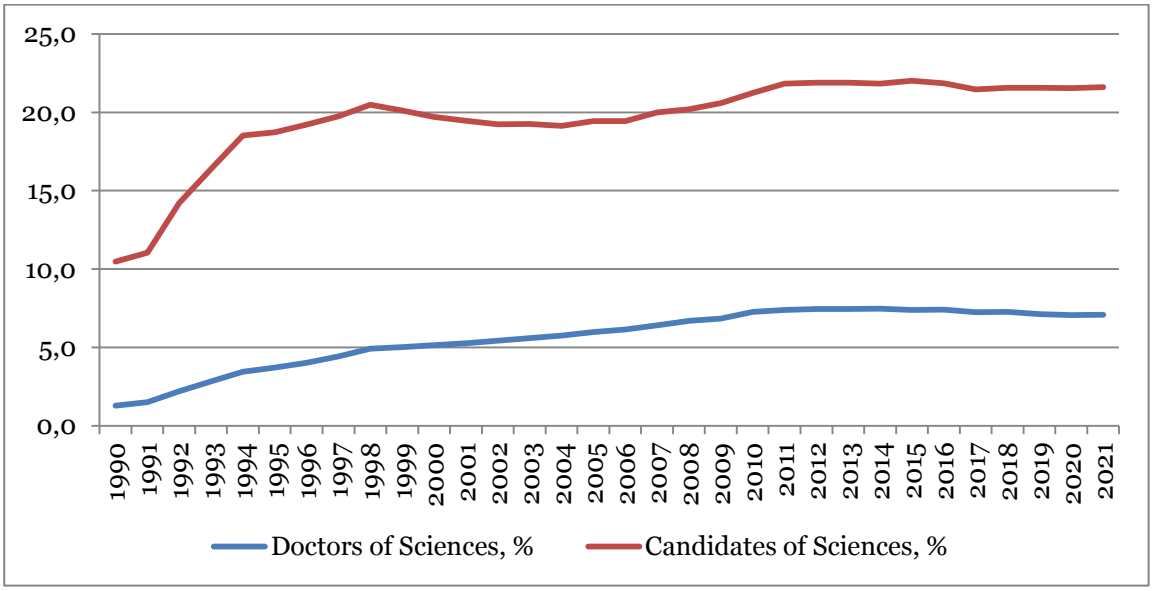

Fig. 3. Dynamics of the share of researchers with academic degrees, % of the total number (Source: compiled by the author according to (Vlasova i dr., 2023a; Federal'naya sluzhba...; Obrazovanie v Rossii..., 2003; Rossiiskii statisticheskii ezhegodnik..., 1996)

The proportion of candidates had its maximum growth rate in 1990–1998, although this increase owed to a considerable decline in science workers without academic degrees. Next followed a period of relatively stable change in the number of researchers overall and those with candidate degrees in particular. In contrast, the share of doctors of sciences had a continuous rise until 2010, after which it has been steadily decreasing.

Thus, in the past 30 years, the R&D community has seen a major increase in the number of scientific workers with academic degrees. The greatest phase of relative growth occurred in the 1990s when the least valuable employees without degrees were the first to be dismissed.

Now, let us consider the work of postgraduate schools in terms of the number of postgraduate students and the statistics of admission and graduation.

Table 1. Dynamics of the number of postgraduate students, admission and graduation from postgraduate programs, persons

Year	Number of postgraduates at the end of the year	Admission	Graduation from postgraduate programs		Share of graduates who defended their dissertations, %
			total	with thesis defense	
1970	66,600	n.d.	17,100	3,300	19
1980	66,642	19,600	16,596	2,800	17
1990	63,156	17,500	16,336	3,500	21
1992	51,915	13,865	14,857	3,135	21
1995	62,317	24,025	11,369	2,609	23
2000	117,714	43,100	24,828	7,503	30
2005	142,899	46,896	33,561	10,650	32
2010	157,437	54,558	33,763	9,611	28
2011	156,279	50,582	33,082	9,635	29
2012	146,754	45,556	35,162	9,195	26
2013	132,002	38,971	34,733	8,979	26
2014	119,868	32,981	28,273	5,189	18
2015	109,936	31,647	25,826	4,651	18
2016	98,352	26,421	25,992	3,730	14
2017	93,523	26,081	18,069	2,320	13
2018	90,823	27,008	17,729	2,198	12
2019	84,265	24,912	15,453	1,629	11
2020	87,751	27,710	13,957	1,245	9
2021	90,156	27,992	14,326	1,500	10
2022	109,705	45,075	13,865	1,791	13

Source: compiled by the author according to (Vlasova i dr., 2023a; Federal'naya sluzhba...; Obrazovanie v Rossii..., 2003; Rossiiskii statisticheskii ezhegodnik..., 1996).

If we consider the number of graduates with defended dissertations as an indicator of the quality of work of postgraduate schools, Table 1 offers interesting information. Until the collapse of the USSR, this indicator was markedly stable, and from 1995 to 2005, it saw a considerable rise in the number of defended theses. Essentially, the system of training of higher qualification personnel had been working stably for decades and demonstrating an upward trend. Yet reforms of the past decades intended to improve the situation have, on the contrary, had an extremely negative impact on the quality of work of postgraduate schools. The number of graduates with successfully defended dissertations has reduced to significant values on the scale of the past 50 years. In this, of key importance is not so much lowering the relative share of defenses as the reduction of their factual number – since the peak of 2005, the number of defenses has declined 6 times. This is approximately half of the Soviet average of 1970–1990 (about 3,000 annually). As follows from Figure 1, candidates of sciences are already part of the scientific community that has undergone significant cuts over the past 30 years. Such a noticeable drop in the number of graduates

defending their doctoral theses will further worsen the situation in the scientific field, creating an artificial shortage of the youngest and most promising higher qualification personnel.

Now, let us consider the same indicators of the work of the doctoral school (Table 2). Unfortunately, the array of data in this sphere is limited to the period of 1990–2022.

Table 2. Dynamics of the number of doctoral students, admission and graduation from doctoral programs, persons

Year	Number of doctoral students at the end of the reporting year	Admission to doctoral programs in the reporting year	Graduation from doctoral programs in the reporting year		Share of graduates who defended their dissertations, %
			total	with thesis defense	
1990	1,772	n.d.	71	31	44
1991	1,834	n.d.	430	154	36
1992	1,644	540	617	247	40
1995	2,190	904	464	137	30
2000	4,213	1,637	1,251	486	39
2005	4,282	1,457	1,417	516	36
2010	4,418	1,650	1,259	336	27
2011	4,562	1,696	1,321	382	29
2012	4,554	1,632	1,371	394	29
2013	4,572	1,582	1,356	323	24
2014	3,204	166	1,359	231	17
2015	2,007	419	1,386	181	13
2016	921	397	1,346	151	11
2017	1,059	439	253	65	26
2018	1,048	393	330	82	25
2019	955	386	356	82	23
2020	979	351	339	63	19
2021	932	210	354	87	25
2022	888	340	316	77	24

Source: compiled by the author according to (Vlasova i dr., 2023a; Federal'naya sluzhba...; Obrazovanie v Rossii..., 2003; Rossiiskii statisticheskii ezhegodnik ..., 1996).

Table 2 indicates that in 2014 and 2017, there was a dramatic decrease in the number of doctoral students coming to and graduating from doctoral programs. There was also a multifold decrease in the number of defenses, although the proportion of graduates who defended their dissertations rose.

Here we observe processes similar to those in postgraduate schools with similar conclusions about a possible future shortage of higher scientific personnel in this category. Yet in this case, the staff shortage will be less noticeable, because, as demonstrated in Figure 1, the number of scientific personnel with doctoral degrees had been growing up until 2015, while the number of candidates of sciences engaged in research has been decreasing with varying speed throughout the past 30 years.

After the quantitative and qualitative assessment of the dynamics of change in personnel training in higher education, it is worth focusing on the statistics of graduation by the primary branches of science.

Analyzing data in Table 3, we can conclude that there has been no radical change in the structure of admission to and graduation from postgraduate schools from 1995 to 2022. The cumulative share of graduates of natural, medical, and technical profiles (in Table 3 these are specialties from physics and mathematics to agriculture) was 62 % in 1995. In 2022, there were the same 62.2 %. There have been no fundamental structural changes over the past 30 years in

practically all fields of study. Of note is only a slight increase in the share of law and political science graduates, as well as those in cultural and sociocultural studies.

Table 3. Dynamics of graduation from postgraduate studies in the main areas of training, persons, %

Title	Graduation from postgraduate school, persons						With thesis defense, %			
	1995	1995, %	2000	2010	2022	2022, %	1995	2000	2010	2022
Total	11,369	100	24,828	33,763	13,865	100	23	30	28	13
including by branches of science:										
physics and mathematics	1,157	10.2	1,933	1,771	1,102	7.9	15	21	25	25
chemistry	387	3.4	725	878	483	3.5	19	35	35	26
Earth sciences	402	3.5	971	1,159	536	3.9	16	21	20	8
biology	561	4.9	1,354	1,680	734	5.3	20	29	26	14
architecture	54	0.5	130	…	40	0.3	2	12	…	3
technology	3,062	26.9	6,208	7,761	3,333	24.0	17	23	25	12
medicine	947	8.3	1,730	2,798	1,628	11.7	46	52	44	11
agriculture	502	4.4	1,047	1,078	774	5.6	17	31	27	22
psychology	216	1.9	483	770	242	1.7	25	29	28	12
economics and management	993	8.7	3,807	5,887	1,133	8.2	27	36	30	9
sociology and social work	185	1.6	391	548	157	1.1	34	34	29	3
law	263	2.3	979	2,554	754	5.4	35	35	22	7
political science and regional studies	71	0.6	199	466	188	1.4	24	28	27	9
education and pedagogy	653	5.7	1,414	2,179	845	6.1	36	44	32	6
linguistics and literary studies	659	5.8	1,320	1,573	593	4.3	24	29	35	21
history and archeology	549	4.8	892	1,093	430	3.1	24	31	31	12
philosophy, ethics, and religious studies	367	3.2	607	670	215	1.6	29	32	30	7
art history	312	2.7	438	521	247	1.8	3	5	15	6
cultural studies and sociocultural projects	18	0.2	163	223	121	0.9	33	32	25	14

Source: compiled by the author according to (Vlasova i dr., 2023a; Federal'naya sluzhba...; Obrazovanie v Rossii..., 2003; Rossiiskii statisticheskii ezhegodnik..., 1996).

Let us now consider the same indicators for doctoral schools, which are provided in Table 4.

Table 4. Dynamics of graduation from doctoral studies in the main areas of training, persons, %

Title	Graduation from doctoral school, persons						With thesis defense, %			
	1995	1995, %	2000	2010	2022	2022, %	1995	2000	2010	2022
Total	464	100	1251	1259	243	100	30	39	27	23
including by branches of science:										

physics and mathematics	51	11.0	178	100	14	5.8	25	26	27	43
chemistry	12	2.6	44	38	7	2.9	50	32	24	14
Earth sciences	12	2.6	45	45	5	2.1	8	36	11	-
biology	12	2.6	36	47	9	3.7	42	22	17	11
technology	147	31.7	355	324	74	30.5	31	42	31	23
medicine	23	5.0	76	74	1	0.4	52	53	30	-
agriculture	4	0.9	14	38	4	1.6	50	57	26	50
history and archeology	26	5.6	65	46	12	4.9	19	31	22	8
philology	28	6.0	81	100	16	6.6	29	31	24	19
philosophy	28	6.0	42	49	4	1.6	36	36	39	0
art history	3	0.6	2	3	1	0.4	33	100	33	0
cultural studies	0	0.0	3	15	6	2.5	-	0	7	17
psychology	8	1.7	9	25	6	2.5	13	11	16	0
economics	...	...	...	154	45	18.5	...	...	31	27
pedagogy	21	4.5	99	125	14	5.8	5	45	22	7
sociology	9	1.9	27	28	4	1.6	11	48	21	0
law	15	3.2	20	29	21	8.6	13	45	24	29
political science	6	1.3	4	13	-	0.0	0	25	46	-

Source: compiled by the author according to (Vlasova i dr., 2023a; Federal'naya sluzhba...; Obrazovanie v Rossii..., 2003; Rossiiskii statisticheskii ezhegodnik..., 1996)

The structure of doctoral graduates by branches of science also does not show any major change between 1995 and 2022. The only thing to note is a minor decline in the share of graduates in natural sciences, medicine, and technology profiles (similarly to conclusions from Table 3) from 56 to 4 %. Nevertheless, this kind of change cannot be considered significant. Concerning specific branches of science, we can point out a decline in the number of medical graduates.

In this way, we can conclude that against the backdrop of the quantitative reduction of the number of postgraduate and doctoral graduates, there is no notable structural change across the directions of training.

5. Conclusion

Thecorrelation analysis showed that due to the high dependence of innovation processes on the availability of researchers with scientific degrees, the absence of significant changes in the innovation activity of the Russian industrial sector is primarily due to the gradual reduction of personnel – graduates of higher education.

Over the past three decades, Russia has experienced a gradual decrease in the number of researchers in the scientific sphere. The initial collapse in the first half of the 1990s was followed by a slow decline until the present time. This reduction takes place practically in all categories of researchers, except for doctors of sciences, which, on the contrary, have become noticeably more numerous in recent decades. As a consequence, the share of researchers with doctoral degrees increased 5.5-fold from 1990 to 2021.

From 1995 to 2010, there was a major (almost threefold) rise in the number of postgraduate students and doctors accompanied by a rise in the relative share of postgraduate students with defended theses. This exact period is described by many researchers as a "diploma factory" because, according to a range of authors, the scientific value of the bulk of these dissertations was not very high.

The year 2014 was marked by a dramatic drop in the number of postgraduate students and doctors. Admission to doctoral schools lowered almost by 10 times compared with 2013. Accordingly, since 2017, there was a reduction in the number of higher school graduates. In the meantime, despite considerable quantitative shifts, the structure of graduates by branches of science has not changed much since 1995.

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The Role of the School Principal in Motivating Teachers for Professional Development: Case Study of the Municipality of Gjakova in Kosovo

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Abstract

Teachers must always increase their knowledge and develop personally and professionally since teaching is a process that needs to be expanded and improved. This is increasingly in harmony with the perspective of lifelong learning as a characteristic feature of the complexity of the teaching profession, with the main aim of adapting to the rapid changes in development and the current needs of the time. The aim of this study is to look into the impact of professional development on improving teaching quality and the school's cooperation with teachers in achieving professional development.

This paper uses a qualitative research method, where 13 principals of primary and lower secondary schools of the Municipality of Gjakova in Kosovo have participated in the research. From the principals' responses, data were collected based on their opinion regarding the professional development of teachers and practices of cooperation and ensuring the professional development of teachers in the schools where they work.

The results of the research show that the professional development of teachers is considered necessary and important in facing more successfully the challenges of the teaching and learning process, teachers adapt more easily to changes in the educational system and can advance faster in terms of personal and professional.

Keywords: professional development, teachers, principals, cooperation.

1. Introduction

Kosovo has had a long and challenging educational journey. Changes in education were required beginning during this time period, as the primary goal was to improve the quality of instruction. Teachers, schools, and other school participants have an important role in improving the quality of education and obtaining the best possible results. Teachers, who required professional development, were also a part of the changes in the educational process. Seeing the

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value and necessity of professional development, MEST partnered with various organizations to offer professional development programs. Also, the Ministry of Education, Science, and Technology 2011 drafted the Strategic Plan for Education in Kosovo 2011–2016 (KESP), and among the areas and priorities of this strategic plan was to "build an effective and sustainable system of teacher's development that will be suitable for improving the quality of education" (MEST, 2011: 50). As a continuation of this strategic plan, the Strategic Plan for Education in Kosovo 2016-2021 places a strong emphasis on advancing teachers' professional development, establishing a sustainable system, and integrating it into their work throughout the teaching process. Guskey (2000) emphasizes that professional development should be considered an "ongoing, job-embedded process of which every day presents a variety of learning opportunities" (Guskey, 2000: 19).

Over a relatively long period, research has identified the continuous development of teachers as one of the fundamental aspects to raise the quality of schools (Borko, Putnam, 1995).

The effectiveness of teacher policies and instructional techniques is also thought to be significantly influenced by this continuing professional development (Desimone et al., 2006).

Changes in education are related to the professional development of teachers, and these changes Werler (2017) sees as "governmental measure that is intended to improve quality of teacher education and school efficiency" (Werler, 2017: 134).

Most changes in the education system are based on professional development, on improving student learning achievements; "*in fact, education reform is often synonymous with teacher professional development*" (Sykes, 1996: 181), this explains also the statement of Fullan (2016) "educational change depends on what teachers do and think" (Fullan, 2016: 97) also Hargreaves and Fink (2006) states that "change in education is easy to propose, hard to implement, and extraordinarily difficult to sustain" (Hargreaves, Fink, 2006: 1).

Studies on teacher professional development have been conducted for decades. According to Desimone (2009), development improves teaching practice and enhances student achievement. In particular, the author claims that a host of study experiences present the professional development of teachers as a challenge to professional measurement. Consequently, the main features of learning experiences throughout the professional development of teachers are one way to address this challenge.

According to Avalos (2011) "teachers learning, learning how to learn, and transforming their knowledge into practice for the benefit of their students' growth" (Avalos, 2011: 10).

An important feature of professional development is the participation and cooperation of all teachers. Usually, these *collective participations* aim not only at sharing new information with the whole group but also at sharing the ideas of the group, and teachers with each other for better opportunities to implement these ideas in the classroom, sharing personal experiences, providing feedback on shared experiences and constructive discussion with the primary goal of developing and improving teachers' knowledge, skills, abilities and practices.

This participation and cooperation can be realized where it is planned for the motivation of learning between teachers with a sustainable system (Cordingley et al., 2005).

The crucial thing for the teacher's professional development is the degree of teachers' support by the management and the degree of professional development based on personal needs and individual development plans of teachers, all this, in the framework of a coherent approach and harmonized with the mission and development objectives of the school (MEST, PIK, 2016).

According to Earley and Bubb, (2004), "professional development does not just happen – it has to be managed and led" (Earley, Bubb, 2004: 80).

A well-run school monitors, analyzes, regularly evaluates, and based on that undertakes actions for its quality improvement. According to the Strategic Framework for teacher development in Kosova, the determination of needs for professional development comes from teachers and the school has the opportunity to draft the activity plan that corresponds to the teacher's needs, and these activities can be developed within the school in cooperation of teachers in between or cooperation between schools (MASHT, 2017). Díaz-Maggioli (2004) specifies that "good administrators are providers, facilitators, communicators, organizers, and evaluators of professional development" (Díaz-Maggioli, 2004: 154).

School and school directors should present the teachers' needs that except professional development programs determined by the Ministry of Education, draft development plans, and other activities within the school that increase the teaching quality, thus implementing professional development based in school (Europian Training Foundation, 2020).

Schools should offer conditions that teachers learn in the school where they work, cooperate, exchange ideas and experiences, keep continuous relations with each other and learn from each-other (Fullan, 2001), with the creation of a positive climate in school teachers rise professionally and in the meantime, it is developed the school quality.

Dufour and Berkey (1995) offers 10 ways of promoting professional development, some of the most important of which are: "identification, promotion, and protection of common values; ensuring systematic cooperation in the school; commitment to professional development; providing staff development programs" (Dufour, Berkey, 1995: 3-5).

The purpose of our study is to look into the impact of professional development on improving teaching quality and the school's cooperation with teachers in achieving professional development.

2. Materials and methods

In order to understand more clearly and in-depth the issues raised in the paper, the qualitative method of data collection was applied, conducted through semi-structured interviews with the principals of primary and lower secondary schools in the municipality of Gjakova. Through this method, opinions and beliefs collected from the words and expressions of research participants are obtained (Matthews, Ross, 2010). The qualitative data collected allows the researcher to get a more in-depth understanding of the opinions of the participants in the research on the school's collaboration with teachers for professional development and the impact of professional development on improving teaching and learning quality.

The research questions are:

- Does the support of the school principal affect the professional development of teachers?
- What are the forms of motivation and cooperation used by school principals for the professional development of teachers?

Populations and research samples

Our study is focused on Gjakova city, as a result, the population includes primary and lower secondary school principals. Thirteen school principals were interviewed in the research.

The size of the sample (13 school principals) is a sufficient number to represent the region of Gjakova in the Republic of Kosovo. The included subjects belonged to different ages (31-60 years) and also had good work experience (between 11-30 years of work experience) (See Table 1).

Table 1. Participant features

Code	Gender	Age	Experience
D 1	Male	51-60	21-30
D 2	Male	31-40	11-20
D 3	Female	41-50	11-20
D 4	Female	41-50	11-20
D 5	Male	51-60	21-30
D 6	Male	51-60	21-30
D 7	Male	41-50	11-20
D 8	Male	41-50	11-20
D 9	Male	51-60	21-30
D 10	Male	41-50	11-20
D 11	Male	41-50	21-30
D 12	Female	41-50	11-20
D 13	Male	51-60	21-30

Research instrument

In this study, interviews were used as a research instrument. During the interview, principals were asked 5 questions through which data was collected based on their perception of teacher professional development and on the practices of cooperation and ensuring teacher professional development.

Data analysis

To analyze the interviews conducted with the directors, thematic analysis was used, where the interview questions were designed and developed by the researchers, and the questions were

previously sent to the persons involved in the research (directors). We conducted an interview with each participant individually, which lasted approximately 20 to 30 minutes, and the variables included in the research were also coded (See Table 1).

3. Results

Results from interviews with school principals

Since a thematic analysis was done, in the results section, we present a table which presents the themes and sub-themes extracted, as well as the frequencies of evidence statements in percentages (For more details, see Table 2).

To the first question: Do you think the professional development of teachers is important and why? With a very high frequency of responses, all school principals see it as very important and necessary as a process, considering it even vital for improving and developing the teaching process and being a successful teacher.

Below are shown two perspectives of principals on this issue:

D7: 'It is very important because education is an ongoing process and in this principle, professional development is also an important factor of teaching.'

D3: "CPD has value for teachers and I think they raise the quality of teaching and learning".

One of the responsibilities of schools/principals is to ensure that the teaching staff in schools is being continuously professionally developed. For this reason, principals were interviewed with the question: How do you as a principal ensure that all teachers are involved in professional development?

From all the answers provided, it is obvious that the principals see it as one of the aspects that is part of their planning for the school. This is because they see the success of the school as closely linked to the continuous professional development of the teachers. With this in mind, most principals have already created some sort of database in their school for the training conducted by each teacher.

Based on this planning, principals develop practices for selecting teaching staff according to their personal training needs, school training needs, and the number of training each teacher has.

Below is a principal's perspective on this issue:

D12: 'I analyze the training of each teacher, make a list of who has been, who needs it most. We instruct them to participate and then in turn everyone is involved in the training'.

Principals were asked: How do you help teachers regarding their professional development?

The point of view of principals, from most of their answers, is related to the professional independence of teachers and the level of their cooperation with teachers. Their central tendency is to define school-based professional development, taking into account the interests of teachers but also the school's need for specific training.

Principals appreciate the skills of their school teachers and in the context of cooperation with them. Principals agree that part of the training for which school teachers themselves are trainers take place in schools because they facilitate the process of understanding and acquisition of training content and make the effectiveness of this training more secure.

Two perspectives on this collaboration:

D4: 'Training should be done in schools, trainers should realize the training at our request and in our school. At the end of the training, an evaluation should be done through tests and everyone who gets certain points based on them should also get the certificates'

D12: 'In our school, we have teachers who are certified as "trainers", then we can hold the training in our school, I think it would be much better since the teachers are freer, they make discussions and questions and suggestions more easily, I think that the training becomes more concrete.

The common point of the school/principals with the teachers is the quality assurance in education, the principals were asked: How do you cooperate with the teachers to achieve this?

Most school principals have shown very similar attitudes.

Regular joint meetings with the teaching staff, defining the positive and weak aspects of the teaching process, frequent meetings both individually or with the professional, continuous reporting, classroom monitoring, and then conversations and advice with teachers for improvements where needed.

Common attitudes of principals include the care of proper planning and organization, starting from the daily, monthly, and annual plan, during which topics, activities, teaching methods and techniques, use of technology, and organization of meetings and meetings are discussed. In which the objectives and evaluation practices for their realization are set, etc.

Two principals think so:

D10: 'At the beginning of the school year we present the objectives and goals we want to achieve. During the year we discuss how much they are doing, and where are the setbacks and help them to overcome them and achieve the planned results.

D12: 'Meetings with staff, conversations about the challenges that teachers have, their requirements in relation to the challenges that they encounter during teaching. I try to analyze the requirements of each teacher separately and discuss them in order to reach their solution'.

The interview question was also asked: In your school, what are the practices that motivate teachers to cooperate with each other during and after professional development training?

From the answers of the principals, in all schools, the emphasis is placed on the exchange of information between teachers. The most common forms are joint meetings, constructive discussions, sharing information from teachers who have participated in the training, determining the positive aspects of the training but also the less likable aspects, etc.

In one of the schools, the principal offered the practice of assisting teachers to each other in class. Then, in the organized meetings, the observed specifics and the benefits from the contents of the attended training are discussed.

Answers from two principals

D13: 'I give teachers the opportunity to go to each other's classes to see how they are applying the knowledge gained from the training and to share the experience gained. To help each other with everything they have learned in training to tell about everything and the good and bad they have experienced from training'.

D8: 'In our school, cooperation is necessary for work, it is always talked about, it is like a kind of collegial rule and task. This was done as a "regulation" in our school'.

Table 2. A thematic analysis presented through a tabular representation of the main themes, sub-themes and the frequencies of evidence statements

Themes	**Sub-themes**	**Frequency N = 13**	**Percentage %**
The importance of professional development	Important	13	100
Reasons why teachers should participate in trainings	Teaching and learning quality increase	5	38.46
	New teaching methodologies	4	30.77
	Professional and personal growth	4	30.77
Inclusion of teachers in professional development	Analysis and notes for teachers, ranking	8	61.54
	Databases	1	7.69
	New teachers	1	7.69
	Old teachers	1	7.69
	Teacher's initiative and demand	2	15.39
Aid from principls for teacher professionl development	Holding trainings at school	6	46.15
	Research, self-evaluation for trainings the teachers need	4	30.77
	Shorter trainings for specific subjects	3	23.08
The form of cooperation between the principal and teacher	Joint meetings, discussions, ideas, consultations	8	61.54
	Organization, planning of objectives	5	38.46
School practices that	Training analysis	5	38.46

motivate the teachers to cooperate with each-other during and after the professional development training	Discussions, experience exchange	6	46.15
	Participation in class	2	15.39

4. Discussion

School principals who successfully carry out their duties, in the school, must promote and support the continuous professional development of all school personnel and at the same time find a way to cooperate between the staff, the school, the students, and the community (Buleshkaj, Mehmeti, 2013).

From the findings of the paper, the professional development of teachers is considered not only necessary but also very important due to the changing demands of students and the school, the more successful coping with the challenges contained in the teaching and learning process, the adaptation of teachers to changes in the education system, personal and professional advancement of teachers. In Yangambi's research with principals and teachers, the results show that the professional development of teachers is important and vital for the teaching profession (Yangambi, 2021). Also from the research of Chalikias et al. (2020), conducted with 180 teachers in Athens, the results showed that the school principal should be a leader of teachers for professional development and a supporter of lifelong learning (Chalikias et al., 2020).

The same attitudes of the principals include frequent and regular meetings with teachers, the organization and planning of professional development by the principals as well as by the teachers affect the improvement of the quality of school teaching in general.

According to Bredeson (2000), "The role of the school principal is to encourage, nurture and support teacher learning, not to be the gatekeepers or governors of teacher professional development" (Bredeson, 2000: 390).

Principals emphasize the level of cooperation, the positive climate that is created, the climate of constructive debate, creating an environment in which teachers share with each other and help each other. From the systematic reviews and meta-analyses of 18 articles by Garcia-Martinez et al. (2021), the findings showed that principals play a key role in creating a climate of cooperation in the school and that the obstacle to creating a climate of cooperation is that teachers are reluctant to share experiences and teachers' non-participation in training (Garcia-Martinez et al., 2021).

5. Conclusion

According to the conclusions of this study, one of the most important and decisive variables for increasing the quality of teaching and learning is the teacher's professional development. School/principals ensure that all teachers are involved in professional development, that there is cooperation and interaction between principals/school and teachers, that school/principals motivate school staff to organize meetings and discussions with colleagues, and that teachers cooperate, discuss, and exchange ideas about professional development practices and their implementation in the learning process.

The director's planning for professional development, organization, the creation of a positive climate in the school, the use of appropriate cooperation practices between the staff, motivating the continuous professional development of teaching, and the improvement of student results and the quality of the school.

6. Declaration of Competing Interest

The authors of the manuscript declare that there is no interest in conflict, and all reference materials were dully acknowledged.

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Appendix

Table 1. Questionnaire

Nr.	Questions of interviews with school directors
1.	Do you think the professional development of teachers is important and why?
2.	How do you as a principal ensure that all teachers are involved in professional development?
3.	How do you help teachers regarding their professional development?
4.	How do you cooperate with the teachers to achieve this?
5.	In your school, what are the practices that motivate teachers to cooperate with each other during and after professional development trainings?

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Assessment by Students of the Influence of Distance Learning Technologies on the Organization of Practice as a Factor of Improving the Quality of Training

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Abstract

Under the conditions of the new sanitary and epidemiological situation, the work of the university have transformed in the field of interaction with the bases of practices and the coordination of information, network communications at specialized enterprises. The purpose of the study is to analyze students' assessments of the organization of practice in pre-pandemic education and in the shift to distance learning technologies to improve the quality of professional training in general.

The basis of methodology is the analysis and generalization of literature in describing the potential of distance technologies to support UNESCO initiatives, identifying problems of their implementation in the university educational environment, and organization of practice. The students' assessment of the influence of remote technologies on the organization of the practice was carried out during the survey through the forms of Microsoft Teams. 124 students of the Moscow Technical University of Communications and Informatics from the Faculty of Digital Economics and Mass Communications were involved in the study learning the courses "Introduction to Information Technologies" and "Information Security".

Research results. In Microsoft Teams a questionnaire has been developed containing blocks: "Distance technologies at the stages of organization of practice", “Satisfactory quality organization of practice lacking distance learning technologies”, "Directions for improvement". The Moodle course implements an appropriate algorithm for organizing practice based on distance technologies.

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In conclusion, the authors describe the ways of modernization of the educational environment for practice organization in line with identified problems to enhance the quality of specialist training.

Keywords: COVID-19, distance learning, practice base, networking, a questionnaire, Moodle.

1. Introduction

The significance of the research is specified by the following factors:

1. In response to the COVID-19 outbreak, UNESCO is not only creating an Education Coalition but also providing direct support to countries in minimizing the negative consequences of the coronavirus, closing institutions, and creating conditions for lifelong learning (More on UNESCO's..., 2023). One of the activities of the Coalition is the development of distance technologies, network communication resources, and e-learning. In particular, with their assistance, the Moodle platform becomes a partner of UNESCO, UNICEF, and the Organization for Security and Cooperation in Europe (OSCE). The international webinars, teacher conferences on the creation of high-quality online classes, and a combination of asynchronous actions (forums, quizzes) with traditional face-to-face interaction take place (UNICEF's activities..., 2023). In the area of education, remote technologies for various purposes are being improved and developed: ClassDojo, Edmodo, Zoom, Microsoft Teams, Google Classroom, Schoology, Skooler, Funzi, KaiOS, Kolibri, Canvas Network, etc.

2. The university practice, as noted by P. S. Tiwari et al., describing the experience of using distance learning technologies during the COVID-19 period, is an fundamental part of the core professional program of higher education. The practice is carried out to consolidate the theory, acquire skills, and form professional competencies (Tiwari et al., 2021). Using the example of training specialists in the professions of the space industry (implementation of simulation programs), the authors highlight the specific challenges of including distance learning technologies during theoretical training, performing scientific research, term and graduation papers. P.S. Tiwari et al. clarify the peculiarities of interaction between interns and representatives of organizations (Tiwari et al., 2021).

Many problems of practice organization using e-learning, as O.V. Lisovsky et al. prove, analyzing the possibilities of distance learning in practical skills during the COVID-19, are due to inadequate progress of the supervisory background (Lisovsky i dr ., 2021).

3. Within the framework of scientific research, an analysis of students' assessments of the educational environment depending on distance learning technologies is carried out (Gulbianova i dr., 2021). For example, I.E. Sokolovskaya studies the socio-psychological factors of student satisfaction during a pandemic (Sokolovskaya, 2020). R. Imane offers new methodological techniques for involving students, increasing their motivation and cognitive activity (Imane, 2021). The questions of the corresponding questionnaires are aimed at identifying changes in the quality of life of students, the intensity of communication in real life, and freedom of movement.

Thus, the development of e-learning is not only a forced response of international organizations, national ministries of education. E-learning and distance learning can potentially provide significant assistance in quality improvement of education, professional networking, and implementing methodological changes (Al Lily et al., 2020).

At the same time, it is obvious that many universities have experienced and are experiencing difficulties with the introduction of new technologies in the educational environment. Under these conditions, it is essential to confirm the dissemination of didactic principles and standards, which will be accepted not only at the administrative level, but also by teachers themselves, university students.

An important factor contributing to the adoption of e-learning and the organization of the practice of students by means of distance learning technologies is their perception as a relative advantage. In other words, both students and teachers must understand that the applied innovation is better than the tool or practice that it replaced.

Thus, when formulating the hypothesis, we took into account both the provisions of the works of P. S. Tiwari et al. on the need to improve the methodology for organizing practice using distance learning technologies (Tiwari et al., 2021). So are the conclusions of A. Al Lily et al. on the importance of keeping in mind the specifics of higher education when conducting virtual learning (Al Lily et al., 2020).

The hypothesis of the study is that the quality of training of future specialists will increase if, when organizing practice using distance learning technologies, the work includes:

- assessment by students of the influence of distance learning technologies on the level of organization of practice (on the issues of specially designed questionnaires);
- regard to the identified problems and areas of improvement in the algorithm for organizing practice using distance learning technologies.

1.2. Purpose and objectives of research

The purpose of the work is determined from the need to analyze students' assessments of the impact of distance learning technologies on the level of organization of practice to improve the quality of training of future specialists.

The objectives of the research are:

- to describe the potential of distance learning technologies to support the initiatives of the UNESCO Institute for Information Technologies in Education;
- to identify the problems of introducing distance technologies into the academic environment especially at the organization of students' internship;
- to develop and implement an algorithm for organizing practice based on distance technologies;
- to describe the directions of modernization of the electronic information and academic environment for the organization of practice under the identified problems for the quality improvement of training;
- to empirically check the impact of the proposed system of work.

2. Relevance

2.1. Literature review

The literature analysis was performed in the following areas:

1) identifying the potential of information technologies to support UNESCO initiatives, minimize the negative consequences of the coronavirus, and create conditions for continuous learning;

2) the possibility of using remote technologies to organize various types of practices;

3) the difficulties of using distance learning technologies for organizing students' practice, and the establishment of professional competencies of future specialists.

2.1.1. Russian scientific and pedagogical literature review

In their work, S.Yu. Knyazeva, D.M. Kapelyushnik, E.N. Pushkareva, summarizing the experience of the UNESCO Institute for Information Technologies in Education in Moscow, note: despite all the advantages and functionality, the initiative to escalate the quality of education through the introduction of innovative transformations relied on the use of distance learning technologies is still unrealized (Knyazeva i dr., 2020). They conceive of the simple transfer of offline work methods, traditional methods of interaction into a remote format as one of the reasons for the current situation.

V.A. Azev, E.V. Kobets, V.A. Vasiliev summarize new trends and strategies for integrating distance technologies in education. They indicate areas for improvement: alternative forms of obtaining information, requirements for online learning platforms and open educational resources, models for evaluating learning outcomes, research and analytical work methodology for monitoring e-learning (including the process of students' internships in obtaining professional skills) (Azev i dr., 2021).

N.K. Melnikov proposes using virtual platforms for organizing project activities (Melnikov, 2021). And meanwhile, scientists point out that some universities have experience of work with Internet access providers in the direction of opening equipped rooms with computers for independent work in dormitories.

Exemplified by the Faculty of Journalism of the Belarusian State University, T. V. Silina-Yasinskaya describes organizational problems, the difficulties of ensuring the continuity of the educational process and work practice (Silina-Yasinskaya, 2020). T.V. Silina-Yasinskaya notes that students, with virtually no damage to the implementation of the creative part of the practice program, could, being in a safe environment at home at the computer, collect and edit materials; apply remote forms of information retrieval; conduct remote interviews; make up layouts of

newspaper pages and mount stories; take part in the work with the Internet sites and social networks of organizations, etc. In the context of the work, we note that interaction with practice leaders from the organization was also carried out using Internet resources. For the formation of professional competencies (with the technical capabilities of the practice bases), students remotely attended planning meetings, editorial boards (Silina-Yasinskaya, 2020).

In the third block of analytical work with literature, we note the conclusions of O.V. Lisovsky et al., which systematize various technical (congestion of communication channels), philosophical and ethical (degree of trust in digital tools), organizational students), methodical (lack of effective methods, ways of interaction) and normative problems of organizing students' work experience on the basis of distance learning technologies (Lisovsky i dr., 2021).

V. Silina-Yasinskaya points out that for the first time some universities faced the need to conduct internships in online mode, some transferred internships to the next academic year (Silina-Yasinskaya, 2020). As the shortcomings of students' internships in the online space, the author highlights the inability to actually study the structure of the organization and its divisions, go on business trips, and participate in organizational and mass work.

A. Azev, E.V. Kobets, V.A. Vasiliev note that the transition to a new mode of study caused stress for all participants in the didactic process: teachers, students, heads of organizations (Azev i dr., 2021).

So, the COVID-19 pandemic made distance forms of education in demand at school and university (Matveev i dr., 2022). Kh.N. Gyulbyakova, E.A. Maslovskaya, A.Yu. Airapetova, M.V. Larsky summarize that practice is an important part of the higher education program. It must be executed in the form determined by the educational organization (Gulbianova i dr., 2021). O.G. Antonova, Yu.R. Khairullina, E.V. Shchanina establish that under the current conditions, universities have tested, various options for organizing the practice of students (postponement, full and partial transfer to a remote format, the traditional pre-pandemic version) (Antonova i dr., 2020).

Yu. Petrova and M.Yu. Pechalnov conclude that in all cases of organization of students' practice with the use of distance learning technologies, some rules are required that regulate the contractual relationship between the organization and remote student during practice; ways and nature of the use of means of professional communication; location of the workplace and the share of working time used at it (Petrova, Pechalnov, 2020).

Thus, there is a growing need to ensure the effectiveness of communication processes between all participants in the practice (heads of organizations/practice bases, practice base staff, student trainees, curators from the university).

2.1.2. Foreign literature review

In the first analytical direction, we note the results of studies by K. Shahid, Q. Yang, Z. Xingqi (Shahid et al., 2019). The scientists substantiate and prove with empirical data that modern software tools have powerful tools for working with textual, numerical and graphic information, which forms the educational environment foundation in the situation of the COVID-19. In their opinion, a qualitatively new global learning environment is being formed. M. van der Velde and ed. note that there are new functionalities and services for performing practical tasks, exercises and tests; listening to online lectures; downloading materials for self-study; activating the work of chats and receiving prompt feedback from participants in didactic networking (van der Velde et al., 2021). D.B. Ramos et al. present an approach to developing a learning trajectory model in the e-learning system (Ramos et al., 2021). The authors demonstrate how the model can be used for visual representation of the learning trajectory (including the process of students' internship), behavior analysis.

D. Fujs et al. note that online learning has become a necessity in modern society (Fujs et al., 2022). Due to the COVID-19, being indoors in groups has become a big problem. There was a need for social distancing and forced quarantine. For this reason, educational organizations are switching to distance learning. The authors consider the didactic potential and tools of video conferencing. The authors prove that, thanks to the development of modern software solutions, communication technologies and the construction of video conferencing, it was possible to activate the students' cognitive activity, maintain discipline, diligence, and direct cognitive activity (Fujs et al., 2022).

A. Al Lily et al. note that the need for e-learning is undeniable. Nevertheless, in practice, both students and teachers experience serious problems that hinder successful learning. Scientists

analyze how e-learning is developing in the Arab world, what its place is in the general and higher education of the Arab countries (Al Lily et al., 2020).

A. Al Lily et al. highlight the potential social benefits of ICT: meeting the increasing public demand for education due to population expansion and the associated growth in students; desire for various forms of education; the need for professional mobility of workers in a developing country, the development and retraining of personnel; promoting the education of girls and adults in the Arab world, etc. (Al Lily et al., 2020). A. Al Lily et al. highlight real difficulties with adapting to online classes; low computer literacy, technical problems; inept use of time; weak self-motivation (Al Lily et al., 2020).

As part of the second direction, we note that J. N. Al-Karaki et al. describe the methods of conducting educational practices of students with the benefit of virtual laboratories (Al-Karaki et al., 2021).

Valuable for the presented study is the remark of A. All Lily et al., that virtual lectures are great, but what about practical exercises and practice? The specificity of higher education is such that most of the formed professional competencies of a future specialist are inextricably linked with forms of education that require personal presence (Al Lily et al., 2020). Many of the students will have final and qualifying exams, accreditation procedures. Scientists also describe the psychological problems of distance learning during a period of increased stress.

In the third block of analytical work with the literature, we note the position of V. Kuleto et al. determine that institutions that had the experience of organizing a remote format of classes (for example, for part-time students) were the fastest to adapt to the new mode of study due to quarantine (Kuleto et al., 2021).

So, in conditions of isolation, it becomes particularly hard to manage conflict resolution, provide a sufficient level of students' motivation, and maintain the high-quality formation of competencies in the direction of training (Kanetaki et al., 2021).

Thus, conducting an integrated and comprehensive assessment by students of the stages of organization of practice in pre-pandemic education and in the transition to distance learning technologies will provide additional resources for quality improvement of professional training in the chosen specialty; developing the ability to make independent judgments and conclusions, developing skills for an objective valuation of scientific information, etc.

3. Materials and methods

3.1. Theoretical and empirical methods

We used the following methods in our research: theoretical analysis and generalization of literature in describing the potential of distance learning technologies to support UNESCO IITE initiatives, identifying problems of their implementation in the academic environment, organization of practice.

The students' evaluation of the impact of distance learning technology at the level of practice organization was accomplished in a specially conducted survey. It was implemented using forms in MS Teams. The following reasons are responsible for the choice of a software: management of the security policy at the institute; each team (preparation profile) could quite quickly set up a tab, create a new/add an existing form to collect answers or demonstrate survey results; support collaboration with team members, create notifications for a form, or conduct a quick survey only in your group. It is the latter possibility that makes it probable to consider the details of training, the peculiarities of the organization of a particular type of practice, and the formed competencies.

Forms in MS Teams contained questions (choice, multiple choice, matching, assessment of a statement on a scale, entering your own answer) developed and structured by the authors pursuant to the research hypothesis. The following blocks were provided in the questionnaire for students: “Distance educational technologies at various stages of organization of practice” (assessment of the spectrum, the validity of the choice and problems of the software and hardware used separately for the university and practice base); “Satisfactory quality organization of practice lacking distance learning technologies (directly at the enterprise, in the organization)”; "Satisfactory quality organization of practice of practice using distance learning technologies"; "Directions for improving the actions of the university/base of practice in remote interaction". An algorithm for conducting practice was proposed as a result of processing the questionnaire distance learning technologies. It is presented below in the form of a Moodle course.

The base of the experiment is the Moscow Technical University of Communications and Informatics. When forming the experimental and control groups, the results of previous educational and research activities of students, reflected in individual educational routes, expert opinions of teachers of the courses Introduction to Information Technology, Information Security, self- and mutual assessment were analyzed. The final diagnostics took into account points from the head of the practice at the organization and from the university, marks for the report and the implementation of an individual task, self- and mutual assessment, public reports.

To determine the future specialists' quality of training in the course of various types of practices, the levels "high", "low", "medium" were introduced. The methodology for determining the levels is described below (program and results of the study). On average, the age of the participants was 22 years (50 % girls and 50 % boys). The size and composition of the sample is justified by the specifics of the study.

Statistical processing of the results was performed as follows:

1) Fisher's test was used to verify the reliability of the data obtained from the questionnaire materials, in accordance with the research hypothesis;

2) Pearson's chi-square test – $\chi 2$ was used to identify statistically significant differences between students in the experimental and control groups in levels of professional training.

3.2. The base of research

The main goal of the experiment was to assess the educational value of activities for the comprehensive and systematic assessment by students of various stages of practice and its types in pre-pandemic education and in the transition to remote learning technologies to measure the progress in the quality of professional training of future specialists.

The study covered 124 students of the Moscow Technical University of Communications and Informatics from the Faculty of Digital Economy and Mass Communications while studying the courses "Introduction to Information Technologies" and "Information Security"(theoretical analysis of the topic "Message, data, signal, attributive properties of information, quality indicators information, forms of presentation of information", "Information transmission systems", etc.). Students in the areas of training: 42.03.01 Advertising and public relations (profile Advertising and public relations in the industry); 38.03.01 Economics (profile: Economics and organization of IT business); 38.03.05 Business informatics (profile: Digital solutions for Business) were included in the study.

Industrial practice and project activities are implemented in leading IT companies, telecom and media industries, digital advertising, and PR agencies. The study was conducted from 2020 to 2022. From October to December 2020 (during the COVID- 19) it was carried out remotely.

3.3. Stages of research

At the preparatory stage of the experiment, the potential of new information technologies was determined to minimize the negative consequences of the coronavirus and create conditions for continuous learning and organization of practice.

The possibilities of using remote technologies for organizing various types of practices were clarified as follows: professional network communication between the participants of the practice using available means of communication; prompt informing about current or upcoming events; exchange of files of different formats; assessment of theoretical knowledge, professional skills, and competencies in the direct performance of labor activity (surveillance through webcams); holding consultations; organization of public reports and individual tasks. Various learning platforms (EkStep, Moodle, Canvas Network, Coursera), services for working with mobile phones (Cell-Ed, Eneza Education, Funzi, KaiOS, Ubongo, Ustad Mobile), online courses and online communities (ClassDojo, Paper Airplanes), tools and resources for managing and remotely interacting with students (Google Classroom, Schoology, MS Teams) were analyzed by the authors.

In line with the register of collective agreements on the practical training of students between the institute and enterprises, an assessment of the readiness and capacity of institutions to conduct internships using distance learning technologies (technical, organizational, managerial, information) was made.

Further, the leaders of the practice from the university determined the quality of theoretical knowledge, professional skills, and abilities of students; their abilities to search for information, make organizational/managerial decisions in the area of professional activity, apply knowledge to

solve practical problems, make independent judgments, objectively evaluate information, etc. The results of students' educational and research activities from individual educational routes, expert opinions of teachers of the courses "Introduction to Information Technology", "Information Security", and self- and mutual assessment were analyzed. The obtained data was processed according to the procedure defined in paragraph 4.

Based on the initial diagnosis, each student got a score of 0 to 35 points. Therefore, we could collect data on 124 students, and divided them into two groups of 62 people each called the experimental and control groups. The sample was not random. The experimental group was made up of 50 % girls and 50 % boys.

The second stage of the experiment was designed to determining (possible postponements) the timing and structure of the practice, preparation of application forms for selecting a base of practice, formulating a list of individual tasks. The content of the sections of the practice was determined by its type, form of conduct (stationary, visiting).

The third stage of the study includes the entire schedule of organization by curators from the university of students' practice at enterprises, institutions in the areas of training.

4. Results

4.1. Studying the conditions and experience of conducting an internship using distance learning technologies at the Moscow Technical University of Communications and Informatics

Distance educational technologies are used at the Moscow Technical University of Communications and Informatics by virtue of the Federal Law "On Education in the Russian Federation". The organization of students' practice at the university as an integral stage in the future specialists training is performed using e-learning, distance learning technologies. In the context of the study, by conducting practice in a remote format, we mean the interaction of all its members at a distance using telecommunications and the Internet, the use of new work algorithms. At the same time, all components inherent in practice (goals, content, methods, organizational forms and means, control) remain unchanged.

The performed literature analysis lets us to infer that practice is also a unit of the core professional program of higher education; and an element of the educational process, which allows you to navigate the labor market, find yourself in your future profession. The means of communication used for conducting practice in a remote form of the Moscow Technical University of Communications and Informatics are the LMS Moodle, corporate email, Zoom and services similar to Zoom. The base for the practice of students is laboratories, training centers, subdivisions of the research part, in which the level of the state of documentary support for management, organization of information support corresponds to the direction/profile of training. If the sanitary-hygienic, technical, organizational and managerial conditions comply with the requirements for internship using distance learning technologies, an agreement on internship is concluded with the enterprise.

To understand the didactic potential of using distance learning technologies at various stages of practice and its types, in identifying problems and in order to determine areas for improvement at the faculties of digital economy and mass communication, the heads of the practice initiated measures to conduct a comprehensive and systematic assessment by students of a new learning format. The authors developed a questionnaire, which was originally offered to students through Google Forms, but was subsequently transferred to the MS Teams space. Immediately during the webinar on this platform, you can get the views of the participants in various data presentation formats, without switching to other applications. The following is the structure and content of the questionnaire.

I block. Distance educational technologies at various stages of practice organization.

1.1. Assessment of the kinds of software and hardware used.

1. From the list of software and technical means of distance learning, select those that were used by the heads of the practice from the university at various stages of its organization. Software service options: Zoom, Google services, MS Teams, social networks (VK, Odnoklassniki, Instagram, Telegram Messenger, etc.), email (Yandex, Mail.ru, etc.), Moodle, YouTube, Profuturo.

1a. What service, in your opinion, should be added for the quality improvement of practical training?

1b. What service, in your opinion, is the least conducive to the development of competencies in the area of future professional activity?

2. From the list of tools, select those that were used by leaders from the practice base.

2a. What service, in your opinion, should be added to rise the efficiency of labor activity at the enterprise?

2b. What service, in your opinion, is the least conducive to the development of competencies in the area of future professional activity?

3. Establish a correspondence between the software tools and the stages of practice at which you applied them. Wording options for practice stages: Acquaintance with the institution and its structure, Analysis of organizational and regulatory and methodological documents, Work in an organizational unit, Collection of empirical material and conducting scientific research, Preparation of a report, Demonstration of the results of practice activities.

4. Specify the problems that you encountered when installing the software/direct work with distance learning technologies.

1.2. Assessment of the validity of the choice of distance learning technologies used by the practice base. Rate the degree of your (dis)agreement with the statements presented below, bearing in mind that: 1 – "strongly disagree", 2 – "rather disagree", 3 – "rather agree", 4 – "strongly agree", DK – "I don't know, it's hard to answer.

- Heads of practice at the enterprise have always expediently used the resources of distance learning technologies.

- Heads of practice at the enterprise used distance learning technologies only in critical/emergency cases.

- There are no uniform requirements for the use of distance learning technologies at an organization/enterprise/institution.

1.3. Assessment of the validity of the choice of distance learning technologies used by the university in organizing various types of practice. Rate the degree of your (dis)agreement with the statements below, meaning that: 1 – "strongly disagree", 2 – "rather disagree", 3 – "rather agree", 4 – "strongly agree", "NZ – I don't know, it's hard to answer.

- Heads of practice from the university have always expediently used the resources of distance learning technologies.

- Heads of practice from the university used distance learning technologies only in critical/emergency cases (for example, when there was a delay in submitting the final report).

- In each type of practice, the organizers from the university used various distance learning technologies.

II block. Satisfactory quality organization of practice lacking distance learning technologies (directly at the enterprise, in the organization).

1. Evaluate the quality of your results (experience, skills, marks) on a 5-point scale after completing an internship in a traditional format without using distance learning technologies: (1 - "very bad", 2 – "bad", 3 – " satisfactory", 4 – "good", 5 – "very good").

2. Rate on a 10-point scale the degree of your satisfaction with the quality of organization of practice lacking distance learning technologies: where 1 is "very bad" and 10 is "excellent".

3. Indicate the difficulties that you encountered during information interaction: with the head of the practice from the specialized institution; with the head of practice from the university.

III block. Satisfaction of students with the quality of organization of practice using distance learning technologies.

1. Evaluate the quality of your results (experience, skills, marks) on a 5-point scale after completing the practice in a remote format (1 – "very bad", 2 – "bad", 3 – "satisfactory", 4 – "good", 5 – "very good").

2. On a 10-point scale, rate your satisfaction with the quality of organization of practice in a remote format: where 1 is "very bad" and 10 is "excellent".

3. Indicate the difficulties that you encountered in information interaction by means of distance learning technologies: with the head of practice from a specialized institution; with the head of practice from the university.

IV block. Directions for improving the actions of the university/institution for organizing practice using distance learning technologies.

1. Mark the provisions / proposals that the university should implement to organize practice (using distance learning technologies) in the future:

- Replace the platform/software used to organize practice and coordinate information interaction (based on distance learning technologies).

- Expand the range of information resources and software tools for the quality improvement of interaction with the curators of practice from the university.

- Leave only one in the list of information resources and software (for distance learning technologies) to avoid confusion and misunderstanding.

- You don't have to change anything. Everything is fine.

- State your offer.

2. Mark the provisions / suggestions that should be implemented by the practice base for interaction with students using distance learning technologies in the future:

- Develop requirements for the uniformity of the information resources and software used.

- You don't have to change anything. Everything is fine.

- It is necessary to completely modify the professional interaction at the enterprise (by means of distance learning technologies).

- State your offer.

V block. Evaluation for practice depending on the final report ("excellent", "good", "satisfactory" - credited, and "not satisfactory" - not credited).

4.2. Algorithm for organizing practice based on distance learning technologies

Following the processing of the initial questionnaires, a range of software services was identified to organize the practice with the help of distance learning technologies (for use by both the university and specialized enterprises). Initially, these were two large lists with few repeating elements. For example, faculties used the following resources: social networks (VK, Facebook), Skype; Proctoring, Examus, Zoom; MS Teams; instant messengers (Telegram, WhatsApp), Classroom and other Google services; interactive boards (Idroo, Padlet). In institutions, only mail services and cloud storage, instant messengers, and social networks were used. The heads of practice decided to limit professional interaction with student interns to two official channels: MS Teams and corporate mail. These services were used for prompt and timely information, feedback, and control. All intermediate results of the practice (individual tasks, reviews and statements), reports were necessarily uploaded to Moodle.

At the moment, the survey has been conducted three times (at the end of 2020, at the end of 2021, at the end of 2022).

Analyzing the data, we conclude that if at the first stages of practice students noted the poor quality of communication channels (34 %) and material and technical base (18 %), insufficient coordination of the work of the university and the specialized organization (10 %), then at the moment they are already worried about the content of individual tasks (17 %), deadlines (13 %).

Statistical processing of the data obtained was performed to prove the validity and reliability of the developed questionnaire in terms of confirming the hypothesis (Table 1).

Table 1. Evaluation of the impact of complex work on the success of the practice completion

Group Details	Before the experiment		After the experiment	
	Control group	Experimental group	Control group	Experimental group
Percentage of students who successfully completed the practice	51,6 % (32)	52,4 % (31)	67,7 % (42)	93,5 % (58)
Percentage of students who failed the practice	48,4 % (30)	47,6 % (31)	32,3 % (20)	6,5 % (4)

An online calculator (https://www.psychol-ok.ru/statistics/fisher/) was used for the calculations. The critical value of the Fisher criterion for a significance level of 0.05 (φ_{crit}) is 1.64.

We have accepted the following hypotheses:

H0 - the proportion of students who completed practice using distance learning technologies in the experimental group is less than in the control group;

H1 - the proportion of students who completed practice using distance learning technologies is more in the experimental group than in the control group.

Before the start of the experiment the initial empirical value of the Fisher criterion is 0.157 (φemp = 0.178 < φcrit = 1.64). Therefore, the hypothesis H0 is accepted prior to the start of the experiment. After the experiment the value of the Fisher criterion is 3.858 (φcrit = 1.64 < φemp = 3.858), so the hypothesis H0 is rejected and H1 is accepted.

Thus, the system of activities of the head of practice from the university with students to identify problems and determine areas for improving the work of the faculty following the blocks of the questionnaire created by the authors of the study had an objective impact on the success of their practice with the help of distance learning technologies.

The result of processing the received materials for all blocks of the questionnaire is a generalized algorithm for organizing practice using distance learning technologies. Tasks of practical training: formation of universal and professional competencies through the application of theoretical knowledge; student mastering of forms and approaches of working with information; acquisition of professional experience.

Stage 1 (six weeks before the start of the practice): to conduct a survey of students about the choice of the base of practice using distance learning technologies; find out the presence of target students.

Stage 2 (five weeks before the start of the practice): contact the practice base, agree on the admission of students for practice.

Stage 3. To issue, with the help of distance learning technologies, a form of an individual agreement to students who have chosen an internship in organizations with which there is no collective agreement. Sign an individual contract, send a scan to the head of the practice through the university official channels. Request in the same way from the target audience letters (scans) from the relevant organizations.

Stage 4 (four weeks before the start of the practice): issue a memo, practice schedule, safety journal. Submit content to Moodle.

Stage 5 (a week before the start of the practice): prepare for the organizational meeting using distance learning technologies. Check for an application for an internship, individual assignments for each student, an internship report template. Include in the practice report a route sheet for the head of the practice from the relevant organization (list of competencies for assessment, control procedures). Post documents in the appropriate steps of the Moodle course.

Stage 6 (two to three days prior to the start of the practice): hold an organizational meeting for the practice in MS Teams. Explain the principles of interaction and completion of sections of Moodle. Discuss and fix the deadlines for the submission of materials for each section of the practice.

Create a channel in social networks with the participation of managers from the relevant organization, post an individual task of students in the channel.

Stage 7 (first day of practice). Organize a safety briefing (a separate section in the Moodle course). Here, support is provided to inform the employee about rules such as internal working regulations, occupational safety, fire protection, hygiene and epidemiology regulations and hygiene standards, as well as induction briefings and workplace briefings.

Stage 8 (first week of practice): put on an individual task the signatures of those responsible for the practice from the university and the relevant organization. Post a signed individual assignment in Moodle.

Stage 9 (internship): by means of distance learning technologies (through the MS Teams video channel) to observe the activities of students. Check assignments, control and coordinate the interaction of students with the practice base through a channel created in social networks.

10 stage. 4-5 days before the credit for practice in the Moodle course (step "Report on practice"), students attach the appropriate document.

3-4 days before the internship test, the head of the university starts checking the students' reports, if necessary, sends them for revision. When the final drafts are evaluated as an answer, the signed title page is also attached in Moodle.

11 stage. 1-2 days before the test for practice, it is necessary to transfer to the department in printed form: calendar plans-schedules (with signatures and seals); individual contracts (with signatures and seals); completed individual task (with signatures and seals) – original; review of

the head from the profile organization (with signature and seals) – original; practice report (title page, table of contents, text of the report) – bound in a binder.

12 stage. Organize the public report through a team meeting in the MS Teams video channel.

4.3. Experimental evaluation

4.3.1. The ascertaining stage of the experiment

In the sampling procedure, practice leaders from the faculty and curators of relevant training areas from the practice organization sector are involved.

The selection of participants for the experiment and the sample size are justified by the specifics of the study, the correspondence of the profile of the practice base (its divisions) to the profile of the training program; the availability of distance learning technologies to provide practice in an online format.

The sample of students was not random. The representativeness of the sample is mainly ensured by the method of selecting its participants (respondents). Let's describe its procedure.

Heads of practice from the university determined the quality of theoretical knowledge, professional skills and abilities of students; their abilities to search for information, make organizational/managerial decisions in the area of professional activity, apply knowledge to solve practical problems, make independent judgments, objectively evaluate information, etc.

The results of educational and research activities of students from individual educational routes, expert opinions of teachers of the courses "Introduction to Information Technology", "Information Security", self- and mutual assessment were analyzed. The received data were processed according to the following algorithm:

1. In the course of self-assessment, the student was asked to determine the quality of their educational results on a 5-point scale (professional experience, skills, marks), where 1 is “very bad”, 2 is “bad”, 3 is “satisfactory”, 4 – “good”, 5 – “very good”.

2. The same procedure was carried out during mutual evaluation (only in relation to other students of the group).

As a result of these two procedures, the student could receive a maximum of 10 points.

3. Experts/teachers in academic disciplines set their scores separately for the entire set of general professional (for example, the student's ability to search, critically analyze and synthesize information) and professional (for example, information and reference work with documents of organizations) competencies. According to the results of the peer review, the student could also receive a maximum of 10 points.

4. Data from the individual educational route of the student were analyzed, namely, for the last three control activities (test, project, independent task). The values of the indicators were added up. The student could receive 15 points maximum.

So, as a result of the initial diagnosis, each student scored from 0 to 35 points. Based on the results of measurements, the quality of training of future specialists was determined. Under the quality of training, it was decided to understand the compliance of the level of training of a specialist with the requirements of the professional environment in which he will work.

Methodology for determining the level: from 0 to 15 points (inclusive) – "low", from 16 to 29 points (inclusive) – "medium" and "high" in all other cases. Thus, it was possible to collect data on 124 students, from which the experimental and control groups (62 people each) were formed. The sample was not random. The experimental group consisted of 50 % girls and 50 % boys.

4.3.2. Forming stage of the experiment

This stage of the experiment was supervised by the practice organization sector. Its representatives carried out the direction for practice of students mastering educational programs of higher education – bachelor's and specialist's programs. They also provided advice on paperwork.

The practice organization sector carried out centralized activities to familiarize with the rules of labor protection, as well as with the internal labor regulations in organizations.

When organizing practical training, specialized organizations created conditions for the implementation of the components of the educational program, provided equipment and technical training aids in an amount that made it possible to perform certain types of work related to the future professional activities of students.

As noted earlier, for students in the control group (who also had internships using distance learning technologies), the algorithm of work and the questionnaire from paragraph 4 were not

implemented. They performed tasks according to the standard of the training program, according to the schedule and plan of the corresponding type of practice. Participants in the control group interacted with specialized organizations using e-learning technologies. However, students' assessments, their opinions and conclusions on the level of practice organization were not analyzed separately.

4.3. 3. Control stage of the experiment

At the control stage of the experiment, a comprehensive assessment of the quality of training of future specialists was again carried out.

The scores for self-assessment in the control group were determined according to the same rule as in the input dimension. In the experimental group - according to the answers from the questionnaire (item 1 from block III). The evaluation process has not changed. According to the results of preparing practice materials, completing an individual task, defending a report, a student could receive from 0 to 15 points. Each of the activities was evaluated by the head of practice from the university separately from 5 points. The head of practice from the organization also put marks in his review. He distributed points separately for the entire set of general professional and professional competencies. The maximum student could receive 10 points.

So, as a result of repeated diagnostics, each student scored from 0 to 35 points. Information about the levels of the quality of training of future specialists before and after the experiment is presented in Table 2.

Table 2. Results of the level of specialist training to the requirements of the professional environment

Level	Groups			
	The experimental group (62 students)		The control group (62 students)	
	Before the experiment	After the experiment	Before the experiment	After the experiment
High	5	15	5	7
Medium	30	39	32	35
Low	27	8	25	20

The following hypotheses were accepted:

- H0: the level of training of a specialist to the requirements of the professional environment in which he will work in the experimental group is statistically equal to the level of students in the control group;
- H1: the level in the experimental group is higher than the level of the control group.

For $\alpha = 0.05$, according to the distribution tables, $\chi 2crit$ is equal to 5.99. Thus, we get: $\chi 2obs.1 < \chi 2crit$ (0.14 < 5.99), and $\chi 2obs.\ 2 > \chi 2crit$ (8.27 > 5.99). Therefore, the shift towards improving the quality of professional training of students can be considered not accidental.

5. Limitations

This study has possible limitations:

1. Formation of questions for the author's survey in MS Teams was carried out in such a way as to ensure that the control and experimental groups had the same opinions about the quality of the practice organized by the university, the rank of satisfaction with working with the bases of internships.
2. An important condition is that throughout the experiment, the organization of practice using distance learning technologies, the algorithm of work and the questioning were performed by the same teacher. Questions of the questionnaire were not modified.
3. Evaluation based on the results of work experience is carried out on the basis of the results confirmed by the documents of the relevant organizations.

6. Discussion

Analyzing the validity of the choice of distance learning technologies used by the practice base and the university, i.e. answers from the first block (clause 1.2 and clause 1.3), we note that 67 %

of respondents considered that the profile organization optimally uses professional network communication services.

In relation to the university, the share of such respondents was 69 %. The students' satisfaction with the quality of practice organization using distance learning technologies in the first surveys was insignificant (28 % for universities and 15 % for enterprises). When processing the materials of the latest questionnaires, these indicators increased qualitatively (70 % for universities and 64 % for enterprises).

When discussing the problems and difficulties that students encountered in practice using distance learning technologies (questions in this area are contained in each block of questionnaires), a list of the most relevant and complex was determined: technical (the quality of the Internet connection and channels for network communication, the level of software and technical equipment), methodological (lack of a unified methodology for evaluating the results of work in a remote format), communication (timely awareness of all participants in the practice, promptness of feedback), personal (motivation, independence, conscientiousness).

One of the most discussed difficulties is the coordination of information interaction through various communication channels. For example, a student wrote a response to both the head of practice from the university and from the relevant organization via personal e-mail. According to the norms of conducting practice using distance learning technologies, the teacher cannot count such an answer. A student had to duplicate the answers through three or more channels, there was confusion and excessive nervousness. This affected the quality of assignments, students' motivation and their performance.

Other discussed problems are the deadlines for submitting assignments, receiving prompt feedback.

When discussing the reasons for the influence of such a specially organized activity on the assessment by students of various stages of practice and its types based on distance learning technologies on the quality improvement of professional training, the following assumptions were formulated: new opportunities to influence the content of practice (individual tasks), manifestation of greater independence of judgment, work with electronic documents in crisis/extreme conditions, active information retrieval activities, etc.

In general, after a comprehensive and systematic assessment by students of a new format of education, 24 % of the respondents in the experimental group had a high level of training of specialists for the requirements of the future professional environment. Initially, this percentage was equal to 8 %. The share of students whose quality of future professional training was initially defined as “low” decreased from 44 % to 13 %. It is possible to state that the majority of such participants are occupied by individuals who had a basic level, i.e. made mistakes in analytical activities, at the decision-making level, in the search for organizational/managerial decisions, in an objective assessment of scientific information, etc. In the control group, the changes are less significant. For example, the proportion of students with a "high" level increased by 3 % (from 8 % to 11 %), with a "low" level – decreased from 40 % to 32 %.

In general, the pedagogical experiment indicates that the faculties conduct a comprehensive and systematic assessment by students of the organization of various stages of practice and its types in pre-pandemic education and the quality of future specialists training is positively impacted by the transition to distance learning technologies.

The research materials correspond to the priority areas of activity of UNESCO, UNICEF, the International Institute for Information Technologies in Education to minimize the negative consequences of the coronavirus, creating conditions to support quality lifelong learning (More on UNESCO's..., 2023). The obtained algorithms, procedures for the interaction of participants in the educational process, specialized organizations are possible solutions to the problems formulated in the work of O.V. Lisovsky et al. (Lisovsky i dr., 2021). Generalizations and conclusions from the study complement the provisions of V. Kuleto et al. (Kuleto et al., 2021).

7. Conclusion

Higher education involves obtaining not only theoretical knowledge but also the formation of practical skills and gaining experience in professional activities. The situation with COVID-19 pandemic has qualitatively changed the format of education. The issue of conducting and organizing the practice of students in a remote mode of interaction for many areas of training is relevant. The study summarizes the experience of the Moscow Technical University of

Communications and Informatics. The university took as the basis for the transformations the students' assessment of the organization of various stages of practice and its types in pre-pandemic education and during the transition to distance learning technologies.

At present, in the electronic information and educational environment of the Moscow Technical University of Communications and Informatics, algorithms and procedures are being implemented that are aimed at supporting:

- the possibility of access to curricula, work programs of disciplines (modules), practices, to electronic educational resources;
- the possibility of holding different kinds of classes, and procedures for evaluating learning results, which can be carried out using distance learning technologies;
- the possibility of forming an electronic portfolio of the student;
- the possibility of students' interaction in the educational process, regarding synchronous and (or) asynchronous kinds of interaction via the Internet.

Particular attention in organizing the practice of students using distance learning technologies is paid to the coordination of all members in the process, timely information, prompt response, and systematic control. The range of software tools used for professional network communication is optimized in such a way as to eliminate confusion or loss during file transfer and comply with the terms of the practice plan (schedule). Since the most of the work is done by students on their own (at the workplace at home, in a hostel, etc.), the quality of the formed competencies is mainly determined by the content of individual tasks from the heads of the practice (university, enterprise). For example, when formulating individual assignments, practice supervisors are encouraged to include the following:

- be instructed to familiarize themselves with the rules of internal labor regulations, labor protection, safety, sanitary and epidemiological rules, and hygienic standards;
- apply a systematic approach to solving the tasks;
- to carry out bibliographic work with the involvement of modern information technologies;
- organize monitoring of the current system of documentary support for the organization management (using distance learning technologies) to determine the tasks for its automation;
- collect and analyze scientific and theoretical material using network resources;
- to carry out the interpretation of empirical data using automation systems and visualization of calculations.

Of course, the proposed problem solutions of organizing students' internships based on distance learning technologies are not final. However, their effectiveness in enhancing the training of future experts (in the current sanitary and epidemiological conditions) is proved using statistical data processing methods.

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Social Interaction through WhatsApp and the Roles Played by Students in Learning Environments

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Abstract

There is broad agreement on the positive impact of social interaction on students' learning. However, it has not been analysed whether the role they play in the learning environment is related in some way to the interaction among them. In this study, the relationship between the role played by an actor in a learning environment and the frequency and quality of the social interactions is analysed. An activity was designed to foster and facilitate social interaction among students using the WhatsApp platform. This initiative thoughtfully outlined various roles that students could undertake, alongside establishing specific categories meticulously designed to facilitate the comprehensive analysis and quantification of the quality of these interactions. A comprehensive analysis was conducted on a substantial dataset consisting of a total of 1,136 messages. With these data, a correlation analysis was conducted with the Kruskal-Wallis's test and then a post-hoc test with the Mann-Whitney U test was also performed. The results show that there is no relationship between the role played by actors and the interaction they conduct in a learning environment. Another reading of the same point is that any effort to promote social interaction in learning environments will benefit all the actors involved, regardless of the role they play.

Keywords: social interaction, roles, learning, university education, WhatsApp.

1. Introduction

This research study analyses the relationship between the role played by an actor in a learning environment and the frequency and quality of the interaction achieved.

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Social interaction has been established as a new epistemological orientation, in which the object of study is the system formed by the relationship among subjects and the relationship between subjects and the environment (Marc, Picard, 1992). In learning environments, encouraging peer interaction and support are key factors (Lee et al., 2011). When the interaction is established, it positively influences the active learning of students (Molinillo et al., 2018), the course is more pleasant and effective (Lee et al., 2011), better performance is promoted (Kurucay, Inan, 2017) and it increases students' learning commitment (Wang et al., 2022). Along the same lines, it is important to mention that some authors have found that face-to-face interaction and online interaction have different impacts on the learning process According to Chettaoui et al. (2022), the former favours the desired learning and increases satisfaction, while the latter fosters autonomy and allows the development of greater depth in reasoning. Mena-Guacas, Velandia (2020) complement this by saying that technologically mediated interaction requires sufficient time to consolidate.

The types of interaction can be classified into the ones between student and teacher, student and content, between students (Moore, 1989) and with the interface (Hillman et al., 1994). Additionally, it can also be between teachers, the teacher and the content and even between the data in the content (Anderson, Garrison, 1998). It is worth mentioning that each of these types of interaction generates different results, for example, Bailey, Almusharraf (2022) found that the interaction between students generates greater anxiety towards foreign languages than the student-teacher interaction (Baile, Almusharraf, 2022). In this research, was considered the interaction that takes place between students.

Interaction is understood as the action to establish a relationship with the other. There is interaction when an impact is generated on the actors that establish that relationship (Abril, Alvarado, 2020). Furthermore, Goffman (1959 in Gómez, Shafirova, 2016) point out that the role is a social construction that arises in the interaction and that defines the behaviour of the actors, who in this case are students.

Role play aims to ensure empirical learning in various circumstances by improving the efficiency and availability of educational resources (Sun et al., 2022). The role-play strategy improves students' communication skills (Latif et al., 2018) and is effective in improving their motivation, learning (Saptono et al., 2020) and collaboration (Wang et al., 2020). It also has positive effects on the acquisition of knowledge and improvement of skills (Chen et al., 2021), and induces not only technical learning but also socio-institutional learning and commitment to collective action (Salvini et al., 2016) and is useful for successfully engaging all students when teaching difficult topics (Gillis, Taylor, 2018). However, role pressure has a significant negative impact on learning satisfaction (Guibin, Jinyang, 2021).

Throughout time, students have assumed multiple roles (Yu, 2022), which depends on the area of knowledge, the purpose of the course and the teacher's intention. Bunt (2021 in Lance, 2021), for example, proposed the following three different roles for higher education computer science and information technology establishments: business analyst (reading), web developer (writing) and customer service representative (engaging). Roles cannot be arbitrarily defined in a learning strategy because students engage socially and cognitively with them (Yu, 2022) and agents with similar roles tend to share their learning and specialise in certain subtasks (Wang et al., 2020).

Research on video games has explored the relationship between interaction and roles. Cole, Griffiths (2007) found that massive multiplayer online role-playing games (MMORPGs) are highly socially interactive environments that provide an opportunity to build strong friendships and emotional relationships. The study proved that social interactions in online games form a considerable element in the enjoyment of playing (Cole, Griffiths, 2007). Role playing generates greater student engagement and the interaction in class improves substantially (Pheny, Shun, 2009). In an environment outside of education they can, for example, help couple relationships in the development of social interactions (Hawkins, Hertlein, 2013).

Social networks are rethinking the basic forms of communication, interaction and production of knowledge (Fainholc, 2015), and are implanted in the personal activity of university students (Poza-Luján et al., 2015). For this reason, they encourage an unusual social, professional and academic interest (Cabero et al., 2016). In the present research, the interaction analysed was conducted through WhatsApp groups.

To sum up, it is worth noting that the research project from which this article is derived is titled Network Learning as a theoretical and methodological alternative for the promotion of

interaction in virtual university learning scenarios. This project was approved by the Bioethics Subcommittee of the Bogotá campus of the Universidad Cooperativa de Colombia, through concept 002 of 2017.

1.1. Role's definition and interaction

In this research, the four roles defined by Mena-Guacas (2018) were adopted, which are set forth in Table 1.

Table 1. Description of the actors' roles in a learning environment

Roles	Definition
Distributor	Analyses and distributes activities among their peers
Transcriber	Records everything that happens while the proposed task is being developed
Compiler	Prepares the assigned work reports
Reviewer	Audits the process

Source: Mena-Guacas, 2018

Interaction, meanwhile, is analysed based on frequency and quality. Frequency refers to the number of times an actor participates in a learning environment and quality refers to the value that the interaction brings to the collaboration between actors. Quality was assessed based on the table proposed by Mena-Guacas (2018).

Table 2. Categories to assess the quality of the actors' interaction in a learning environment

Category	Description
Parallel	When work is done together with another person, but without communicating or Messages parallel to the topic of work, such as greetings, farewells, thanks, etc.
Two-way response	Response of one individual to another, in which agreement or disagreement is shown, without arguments
Opinion	Communicative flow between two people, in which the messages are not consistent
Reactive	Coherent response from one individual to another showing agreement or disagreement, with arguments or Simple question
Complete	Coherent conversation of more than two messages in which agreement or disagreement is shown, with arguments or More elaborate question in the context of a conversation of more than two messages

Source: Mena-Guacas, 2018

2. Methodology

The study variables are: 1) the role students play in an activity and 2) the frequency and quality of interaction. The data was taken from a postgraduate course in the Department of Education at Universidad Cooperativa de Colombia.

2.1. Design of the activity

The design of the activity has the purpose of favouring the interaction between the actors of the learning environment. For this reason, it was taken into account that when the interaction works properly, learning networks are formed (Siemens, 2004) and for this to happen, a team goal must be defined, because these generate a dependency between personal success and the success of the team (Johnson, Johnson, 1989). Additionally, cognitive development occurs when there is first a social approach and then an individual approach to the subject (Vigotsky, 1978). Also, there is more success in learning if first there is a connection with the subject and then cognition (Castells, 2009).

The stages included in the activity designed are (Mena, 2018):

- Connection: Approach the subject through resources that generate emotional activation.
- Initial social: Promote interaction with others about the subject of the course, with high control by the professor.
- Individual database: Individual approach to the subject through scientific literature, which favours internalisation.
- Social current cases: Cases that are currently of interest are used to reinforce connection and motivation.
- Asynchronous social: Promote interaction between the actors of the environment on the subject, through documents or cases that are currently relevant.
- Individual closure: Implementation activity of the topics developed with the purpose of promoting internalisation by each student.

The proposed activity was developed in groups. Six groups were organised in the course, which consist of four or five people. The groups formed are small, so that the interaction is significant (Johnson et al., 1997).

2.2. Role assignment

As previously mentioned, the role is a social construction that emerges in the interaction and defines the behaviour of the actors (Goffman, 1959, in Gómez, Shafirova, 2016). The interaction is then the place or moment in which the roles are defined.

Considering the above, first the role that each student would play was identified first and then the groups were organised. The roles were assigned according to the answers that each student gave in a characterization form, about how they react to certain situations and their preferred activities. Table 3 presents an extension of Table 1, with the forms of reaction and preferred activities associated with each of the roles.

Table 3. Characteristics associated with each role

Role	Definition	Characteristics	
		Reaction	References
Distributor	Analyses and distributes activities among their peers	Proposes Searches	Plan Follow up
Transcriber	Records everything that happens while the proposed task is being developed	Searches Analyses	Implement Write
Compiler	Prepares the assigned work reports	Analyses Proposes	Organise Write
Reviewer	Audits the process	Compares Proposes	Read Follow up

Source: Mena-Guacas, 2018

2.3. Interaction assessment

Each of the six groups formed had a group on WhatsApp for the development of the activity. In these groups, a total of 1,136 messages were issued by the students, which are the data used to assess the interaction.

Table 4. Values to quantify the quality of the interaction

Category	Points assigned for each participation	Maximum possible points
Parallel	1	5
Two-way response	1	5
Opinion	3	15
Reactive	26	78
Complete	104	Any number greater than 104

Source: Mena-Guacas, 2018

The frequency of the interaction was assessed based on the number of messages issued by each student and the quality based on the categories presented in Table 2. Each message issued was assigned to one of the categories and then the total score for each student was calculated using Table 4.

The score calculation was done considering the following points, as defined by Mena-Guacas (2018):

- The categories are organised ordinally, so that the quality of the interaction is greater the closer it is to the parallel category.
- It is necessary to define a maximum number of possible points in each category, because continuing to interact in the same one only increases the frequency, not the quality.
- Start with the minimum number of points possible, that is, 1. This value is assigned to the parallel and two-way response categories. It is not zero because that would indicate that there is not even an approach to the other person, but in the first two categories that approach does happen. The maximum was defined at 5, because there is no significant contribution from the two parties.
- In the opinion category, an effort to make a significant contribution is already perceived, which is why it has a higher rating than the previous one, specifically 3. The calculation of the maximum possible points was made keeping the same proportion given in the first two categories (1:5), so in this case the highest possible score is 15.
- In the reactive category there is already an interaction that really contributes to learning because there is coherence between the messages and arguments. This indicates that there is joint construction. In this sense, it is a level that cannot be reached if you interact only in any of the previous categories. Thus, it starts with 26, which is a number greater than the sum of the possible maximums of the previous three categories. To show that someone has definitely managed to place themselves in this category, they must interact at least three times in a reactive way. Therefore, the maximum score is 78.
- Interacting in the full category implies that there is already a conversation of more than two messages with coherence and arguments. This means that this level is qualitatively superior to the previous ones, and this must be reflected in the score. It is defined as 104 because it is greater than the sum of the maximum possible score of the previous categories. There is no maximum limit because the greater the number of interactions with this level, the greater the possibility of learning.

2.4. Correlation

To answer the question, a correlation analysis was conducted between the two variables with non-parametric tests of comparison of the central tendency, because the role is a categorical variable and the interaction (frequency or quality) is ordinal.

The Kruskal-Wallis test was applied, which allows a comparison between various data sets, because there are four roles (that is, four sets) and each set is independent of the others. If an actor plays a role, then he or she cannot play another at the same time. Then, a post-hoc test was conducted with the Mann-Whitney U test, which is used to analyse the relationship between variables through a comparison between two data sets (it was conducted six times, once for each pair of roles).

Finally, it is worth mentioning that the analysis was done first in terms of the quality and then the frequency of the interaction.

3. Results

The results are presented between the quality of the interaction and the role first, and then between the frequency of the interaction and the role. In both cases, the working hypotheses for the analysis of the relationship between the two variables are:

- Ho: Equal medians: the quality/frequency of the interaction does not depend on the role;
- Ha: Different medians: the quality/frequency of the interaction depends on the role.

3.1. Relationship between the quality of the interaction and the role

Table 5. Kruskal-Wallis test between quality of interaction and role

Error	Degrees of freedom (k-1)	Chi square critical value	Calculated H
0.05	3	7.815	4.977954145

Source: Prepared by the authors.

The calculated H 4.977954145 is less than the critical point 7.815. Therefore, the null hypothesis is accepted, and with 95 % confidence it can be stated that the quality of the interaction does not depend on the role.

Table 6. Mann-Whitney U test between quality of interaction and role

	Compiler vs. Distributor	Compiler vs. Transcriber	Compiler vs. Reviewer	Distributor vs. Transcriber	Distributor vs. Reviewer	Transcriber vs. Reviewer
Calculated Umin	11	25	22	7	10	11
Critical U (0.05 error)	10	10	10	5	5	5

Source: Prepared by the authors.

In all cases, the calculated U is greater than the critical U, therefore, with 95 % confidence, it can be stated that the quality of the interaction does not depend on the role in any of the tests.

3.2. Relationship between frequency of interaction and role

Table 7. Kruskal-Wallis test between quality of interaction and role

Error	Degrees of freedom (k-1)	Chi square critical value	Calculated H
0.05	3	7.815	6.421766626

Source: Prepared by the authors

The calculated H 6.421766626 is less than the critical point 7.815. Therefore, the null hypothesis is accepted, and with 95 % confidence it can be stated that the frequency of the interaction does not depend on the role.

Table 8. Mann-Whitney U test between quality of interaction and role

Test	Compiler vs. Distributor	Compiler vs. Transcriber	Compiler vs. Reviewer	Distributor vs. Transcriber	Distributor vs. Reviewer	Transcriber vs. Reviewer
Calculated Umin	10.5	24.5	22	5.5	4	16.5
Critical U (0.05 error)	10	10	10	5	5	5

Source: Prepared by the authors.

In almost all cases (except distributor vs reviewer), the calculated U is greater than the critical U, therefore, with 95 % confidence, it can be stated that the frequency of the interaction does not depend on the role in any of the tests.

4. Discussion

The data shows that there is no relationship between the role played by the actors and the interaction they conduct in a learning environment. These results are different from those proposed by Pheny, Shun (2009), who found that a role-based game improved class interaction (Pheny, Shun, 2009) and from what was mentioned by Hawkins, Hertlein (2013) who mentioned that these role plays help the social interaction of couple relationships (Hawkins, Hertlein, 2013). This may be so because what really differs in each team role is commitment (Zamecnik et al., 2022), so it is likely that there will be more interaction, but it will not necessarily be of better quality. For its part, this result confirms what was suggested by (Pepkolaj et al., 2020), who found

that when the peer tutoring model is implemented, greater effectiveness is achieved when it is done without specific roles.

It was expected that there would be a relationship between the variables because each role has different responsibilities, and this insinuated that some could interact more and with higher quality than the others. The reviewer role, for instance, oversaw auditing the process and was therefore expected to highlight errors, propose changes, and improve the deliverables – all this implies interaction with the other actors. However, considering that the results show that there is no relationship between the variables, it can also be stated that there is no incidence of the role on the interaction, but rather it works as Salvini et al. (2016) stated: a commitment to collective action (Salvini et al., 2016) of the group as a whole is established.

It is important to mention that the role not only has to do with the activities performed, but also with how they are performed. For example, Duc et al. (2020) found that alternating team interaction with open or closed leadership positively impacts exploratory learning. In the study presented in this paper, the leadership profile was not identified, but it could be an interesting idea in the future. It should also be noted that static roles were defined, and this may be the reason why no relationship was found between the role and the interaction, since the flexibility of the roles can improve the functioning of the team (Byerly et al., 2021). In the same vein, Heinimäki et al. (2021) says that the highest performance groups are made up of people with versatile role profiles.

WhatsApp was used as a communication tool in the team activity because according to Urien et al. (2019), the students' perception of its usefulness could help develop positive attitudes towards work as a team, while according to Hidayah et al. (2021), students do manage to interact appropriately through WhatsApp for the development of academic activities. The data from the research presented in this paper show that there is a positive attitude towards teamwork, since the members of the groups interact with each other continuously, but it is also clear that the interaction of the group is not sustained by whoever plays a specific role but by all together. This can be confirmed because there is no relationship between the roles and the interaction. In an analogous manner, the use of WhatsApp on smartphones can increase student learning by encouraging high-level skills and concepts (Alshaibani, Qusti, 2021), which is also not supported by someone who plays an individual role but by the whole group.

When some students do not actively participate in the course, the professor might think that they will be able to motivate their participation by assigning them a role with responsibilities that require more interaction with their peers. The results of this research show that this strategy would not achieve improvements in the participation of these students. But there would indeed be an improvement in the complete environment, so that the results confirm what was mentioned by Gillis, Taylor (2018) in the sense that defining roles is useful to involve all students when difficult topics are taught (Gillis, Taylor, 2018).

Cole, Griffiths (2007) found that MMORPGs are highly socially interactive environments (Cole, Griffiths, 2007). In this regard, they accentuate the high social interaction in the environment as a whole. As the results of this research show that there is no dependency between interaction and role, it can be said that they confirm the idea of Cole, Griffiths (2007), insofar as any effort to promote social interaction will benefit all the actors involved equally: to the entire environment, not just a few. This is also in line with what was specified by Lee et al. (2011), as it confirms that peer support is a key factor in the entire learning environment.

The results of this research are useful for teachers because they show that learning strategies with defined roles allow the promotion of interaction of the group, but not always of all individuals. The group interaction promotes a positively influence the active learning of all students, as mentioned by Molinillo et al. (2018). For the foregoing reason, an interesting line of research on this subject is the design of didactic strategies that foster interaction.

5. Conclusion

Conducted within a well-structured framework, this research study critically analyzed the intricate interplay between the roles assumed by individuals in a learning environment and the consequential frequency and qualitative dimension of the interactions they achieved. The gathered data distinctly revealed a noteworthy pattern, indicating the absence of any substantial relationship between the specific roles undertaken by actors and the manner in which their interactions transpired within the learning milieu.

An alternative yet equally compelling interpretation of these findings underscores the pervasive positive impact of nurturing social interactions within educational settings. This perspective posits that any concerted effort aimed at fostering meaningful exchanges among participants, irrespective of their designated roles, inevitably benefits the entire educational community. This perspective transcends the individual roles played and collectively enriches the overall learning environment, emphasizing the interconnectedness inherent within educational dynamics.

6. Author contributions

Conceptualization, Andrés Mena-Guacas; Data curation, Andrés Mena-Guacas and Camilo Velandia Rodriguez; Formal analysis, Andrés Mena-Guacas; Investigation, Andrés Mena-Guacas; Methodology, Andrés Mena-Guacas; Project administration, Andrés Mena-Guacas; Validation, Andrés Mena-Guacas and Camilo Velandia Rodriguez; Writing – original draft, Andrés Mena-Guacas, Camilo Velandia Rodriguez, Norberto Díaz-Díaz and María Belén Morales-Cevallos; Writing – review & editing, Andrés Mena-Guacas, Camilo Velandia Rodriguez, Norberto Díaz-Díaz and María Belén Morales-Cevallos.

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Student Competencies in Supply Chain Management: Expectations and Reality

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Abstract

The ever-changing competency expectations and human resource shortages in the Supply Chain (SC) field underpin the relevance of our research. Both issues require the attention of all stakeholders (students and universities at the supply side, and employers at the demand side).

Therefore, the aim of this study is to use an inductive approach to help students wanting to enter the field of Supply Chain Management (SCM) to increase their preparedness by mapping the employer experiences and competency expectations.

In 2021 in Hungary, 64 corporate middle managers participated in the online questionnaire and shared their experiences of the competencies of recent graduates.

Using quantitative research, the results shed light on the most expected competencies, the increasingly important role of soft skills, the significant differences between the expected and the experienced traits, such as complex mindset, systems approach, humility and conflict management.

With the revealed results, this study contributes to the professional literature in two ways. On the one hand, it provides up-to-date data about employers' opinion of graduated students, which is rare in the literature. On the other hand, it helps to see the possible causes of the discrepancy between supply and demand in the SC labour market.

Keywords: higher education, logistics, supply chain management, supply and demand, skills, competency, labour market.

1. Introduction

One third of the current jobs could dramatically transform within the next five years, with some of the required knowledge and skills becoming redundant while the demand for new skills increases. It is therefore crucial that the changing competency expectations, which may be generated by technological developments but also by the pressure related to the shortening of order

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fulfilment times (Chung et al., 2018) closely linked to the growth of e-commerce, are constantly perceived by education providers.

Nowadays, the labour market of the transport and storage industry is facing labour shortages and unemployment at the same time in Hungary. In 2021, the number of vacancies per quarter is on average 1.85 % (KSH.hu, 2022). The occurrence of this situation may have been caused by the discrepancy between labour supply and demand, the dynamics of its change, the constantly changing labour market requirements, the inadequate skills, attitudes and expertise (competency) of the employees, as well as the fact that the labour market's demand for human resources raised faster than the number of adequately qualified graduated people in the field of SCM, for example, due to the Covid pandemic.

In our research, we focus on the causes of this discrepancy by investigating the employer expectations (demand side) and the student competencies (supply side) to see where to intervene to reach a better match between the two sides. Our goal is, to influence SCM training, which hopefully will help to meet the expectations of the industry and narrow the gap between supply and demand.

As argued by Dubay et al. (2019) "empirical research on supply chain skill gaps is scant" (p. 144), which indicates the need for this kind of research. We have to know the nature and magnitude of the problem before taking corrective actions.

Therefore, in our research, we sought to answer the following questions:

RQ1: Which competencies do employers expect from graduated students?

RQ2: Which competencies are experienced by employers?

RQ3: Where do employers see discrepancies between their expectations and the current competencies of graduated students'?

2. Definitions and literature review

In this chapter we define the field and the researched topic (competencies) and then see what the literature have so far done.

The field of supply chain management

Before presenting the results, we should define the field (SCM) we are investigating. To do that, we use the definitions of professional organizations most closely associated with the field.

The Council of Supply Chain Management Professionals (CSCMP), which used to be the Council of Logistics Management till 2004, defines supply chain management as follows: "Supply chain management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers, and customers. In essence, supply chain management integrates supply and demand management within and across companies." (CSCMP website, 2023). The CSCMP also defines logistics as "part of supply chain management that plans, implements, and controls the efficient, effective forward and reverses flow and storage of goods, services and related information between the point of origin and the point of consumption in order to meet customers' requirements" (CSCMP website, 2023). Based on these definitions, the major areas of SCM are procurement, manufacturing (conversion) and logistics (including warehousing, distribution and reverse flow activities). Based on research, competency related studies usually cover the purchasing and logistics areas (Dubey et al., 2019).

Competency

The literature lacks a clear definition of the term competency and also shows inconsistent use of the term (Kotzab et al., 2018, Munkácsi, 2021).

Table 1. Competency vs. Competence

No	Term	Main Focus	Definition
1	Competence Competences	Task – Job	Competences are the tasks a person is capable of performing
2	Competency Competencies	Person	Competencies are the personal characteristics which make work performance possible

Source: Bozkurt, 2009

In our research we use the term competency (competencies) from Table 1. Competencies are usually represented as a combination of components such as knowledge, skills, abilities, capabilities and resources (Athey, Orth, 1999; Prahalad, Hamel, 1990; Sanchez, 2004; Munkácsi, 2021, European Union, 2006; ESCO, 2020).

We adopt the definition of competency used by ESCO (2020), and the Council of the European Union (2006): "The proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations, and in professional and personal development. It is one's ability to combine knowledge, skills, and attitude (KSA) to show the expected behaviour when performing a professional task." European universities also use this KSA system to form their assurance of learning outcomes.

According to Gruzdev et al. (2018), Myers et al., (2004), formal skills and theoretical knowledge acquired during university studies are less important for effective work in business than personal qualities. However, the development of these qualities does not yet meet the expectations, which is also supported by the dissatisfaction of the students. Today, the expectation presented in the "Iceberg model" of Spencer et al. (1993) is more and more confirmed, where selection based on personality traits is the basis of efficiency because professional knowledge can be easily acquired.

The research presented above thus supports the growing importance of soft skills and the relegation of professional knowledge to the background, which is now noticeably complemented by the expectations related to attitudes.

Competencies required in the areas of SCM

Since in the last years, employees with the right competencies are of increasing strategic importance, individual competencies receive more and more attention in SCM research (Hohenstein et al., 2014; Dubey et al., 2019).

Bak et al. (2019); and Ellinger and Ellinger (2014) treat it as a fact that soft skills are becoming increasingly important in the logistics sector. Moreover, they have indicated that key hiring decisions tend to focus on soft (interpersonal and relational) skills, while hard skills have become a standard requirement (Kuzminov et al., 2019; Bak et al., 2019). Competency is a key factor in achieving excellent performance and competitiveness in the supply chain (Derwik, Hellström, 2017).

The biggest challenge for training institutions today is therefore to establish and maintain close cooperation with the companies involved, to identify new demands and expectations in the labour market, to monitor changes, to react to them as quickly as possible and to equip the students with the competencies that meet the market demand. (Thai, 2012). In the literature, however, we do not find much research, which address this problem by discovering the gap between required and experienced competencies. Required competencies (see Table 2) are more frequently screened.

The competencies are approached in different classifications. Derwik et al., (2016), in their research, grouped the competencies used by managers working in different areas of SCM into five broad categories: business managerial competence (30-40 %), generic competence (20-30 %), behavioural competence (15-30 %), functional competence (5-20 %), SCM expertise (0-5 %). Clearly, the functional knowledge and expertise of SCM seems to be the least required competencies. In the framework of Myers et al. (2004), the four types of skills were social skills, decision-making skills, problem-solving skills, time management skills. We reorganized the different classifications according to the knowledge-skills-attitude (KSA) breakdown and are summarised in Table 2.

In 2014, the Hungarian Association of Logistics, Purchasing and Inventory Management mapped the expectations and experiences of logistics career starters in the Hungarian market by an online questionnaire. The most important soft skills appeared to be motivation, diligence and learning ability, while the least important category was stress tolerance. The experience of the employers has shown that the areas where graduates should improve the most are precision, diligence, adaptability, shyness, resilience and excessive self-confidence. Docility and easy integration into the existing organization met the expectations well. In sum, the experience scores were on average lower than expected, which not only confirmed the existence of a market gap between education and practice, but also suggests companies' reservations towards recent graduates. This gap and the lack of systematic research investigating the gap initiated our research.

Table 2. Required competencies (KSA)

References	Required competencies (KSA)
Derwik, Hellström, 2017; Flöthmann et al., 2018; Jordan, Bak, 2016; Karttunen, 2018; Kotzab et al., 2018; Murphy, Poist, 2006; Thai, 2012	Hard skills: computer/software skills, financial management, foreign language, analytical skills, cost control, Knowledge about: basic logistics, mathematics, professional experience, logistics related regulations, basic technology, business ethics, local and international business regulation, sustainable logistics systems, reverse logistics, impact of globalization, modeling of operating systems
Bak et al., 2019; Derwik, Hellström, 2017; Jordan, Bak, 2016; Karttunen, 2018; Murphy, Poist, 2006; Thai, 2012; Kotzab et al., 2018; Flöthmann, et al., 2018	Soft skills: decision-making skills, business communication, teamwork, ability to plan, interpersonal relations, problem-solving skills, time management, intercultural management, leadership, infrastructure planning and management, collaboration, innovation and entrepreneurship, stress management
Bak et al., 2019; Jordan, Bak, 2016; Murphy, Poist, 2006; Karttunen, 2018; Kotzab et al., 2018	Attitude: motivation, proactivity, flexibility, adapt to change, learning to learn, enthusiasm, self-confidence

Notes: KSA = Knowledge-Hard skills, Soft skills, Attitude
Source: our own construction

3. Research methodology

The basis of the online quantitative research and the determination of the examined competencies in this study was provided by literature research (EU, 2006; Hofstra et al., 2020; Derwik et al., 2016; Derwik, Hellström, 2017; ESCO, 2020; Flöthmann, Hoberg, 2017; Munkácsi, Demeter, 2019; Patóné, 2006; Pató et al., 2021; Thai et al., 2011).

Employers were asked about 32 competencies based on the literature sources listed in Table 2. The competencies and their values are listed in Table 4. Following the definition of SCM provided by CSCMP, we asked managers of any field of SCM to answer the questionnaire. The question to be answered, which gave the results of Table 4: "In your opinion, which competencies (competency = knowledge/proficiency + attitude + skills/abilities) should a recent graduate possess and to what extent when applying TO YOUR FIELD? (1: Not at all, 5: Fully).

The online questionnaire was delivered to the stakeholders through several steps (weekly newsletter, Facebook, LinkedIn) but only the personal inquiry (was made via email or LinkedIn) led to results. More than a hundred people started to fill in the questionnaire, but some of them did not finish, so we ended up with a total of n = 72. Respondents also indicated the area they manage (procurement, manufacturing, warehousing, distribution, logistics, inverse and other areas). Since many respondents do hold managerial positions in more than one area, that is why the number of individual responses add up to 101 (more than the number of the 72 respondents). The distribution of responses is presented in Table 3.

Table 3. Distribution of employer survey responses on specific areas of SCM

Procu-rement	Warehouse	Manufac-turing	Distri-bution	Reverse	Logistics and distribution managers	Other fields of SCM	Sum
12 (12 %)	20 (20 %)	10 (10 %)	17 (17 %)	2 (2 %)	27 (26 %)	13 (13 %)	101 (100 %)

Source: our own research (2022)

Among the respondents belonging to other categories, you can find providers of shipping, international shipping, lean management (and industrial engineering), complex logistics services, CEP (currier, express, parcel).

4. Results

In the following we provide an overview of the competencies that employers require of recent graduates and what they experience (expectations vs. reality). Significance testing and rank correlation were used to analyze the difference between expectations and reality.

Table 4 contains the 32 examined competencies. The list was created based on the literature. The competencies are arranged according to the most expected. The table contains the results of the significance test between expectations and reality (non-significant values marked with:*), and the strength of the existing relation between the order of expectations and reality, using rank correlation. The strong values of the rank correlation demonstrate that the competencies the graduates possess meet the expectations.

Table 4. Student competencies in SCM: the Employers' Opinion

No.	Competencies	Skills required	Experien-ced skills	Wilcoxon Signed Ranks Test Asymp. Sig. (2-tailed)	Rank Correlation ϱ =.80-1.0 "Very strong"
1	positive approach	4.68	3.74	,000	0.817
2	agility, being motivated	4.47	3.74	,000	0.804
3	communication skills	4.36	3.59	,000	0.790
4	willingness to experiment and innovate	4.36	3.74	,000	0.778
5	complex mindset, systems approach (develop..., plan.. , analyse)	4.35	2.70	,000	0.761
6	ability to use IT tools and software	4.24	3.97	,041	0.812
7	curiosity	4.23	3.89	,015	0.751
8	ensure cross-department cooperation	4.06	3.26	,000	0.728
9	creativity	4.02	3.45	,000	0.706
10	liaise with managers	3.97	3.02	,000	0.686
11	time management	3.97	3.14	,000	0.686
12	humility	3.95	2.79	,000	0.727
13	ability to analyse (large data sets)	3.88	2.95	,000	0.736
14	ability to plan (costs, stocks, customer needs, production)	3.88	2.76	,000	0.732
15	conflict management (liaise with colleagues)	3.86	2.73	,000	0.747
16	self-confidence*	3.86	3.73	,293	0.765
17	ability to follow rules (comply)	3.83	3.41	,007	0.785
18	organisational skills (manage staff)	3.71	2.97	,000	0.808
19	critical thinking	3.68	3.05	,000	0.807
20	ability to manage resources, inventories, costs, risks	3.48	2.71	,000	0.808
21	administrative skills*	3.48	3.47	,817	0.824
22	ability to control (monitor)	3.47	2.86	,000	0.860
23	ability to supervise	3.32	2.91	,001	0.863
24	skills for corporate development	3.27	2.47	,000	0.867
25	risk assessment skills (procurement risk ...)	3.21	2.30	,000	0.866
26	negotiation skills	3.12	2.67	,006	0.873
27	ability to train people	2.97	2.42	,001	0.881
28	ability to make forecasts (financial, dividend, economic trends)*	2.74	2.59	,353	0.878
29	management skills	2.64	2.14	,000	0.875
30	ability to build professional networks*	2.64	2.44	,140	0.862

31	ability to create contracts*	2.20	2.05	,244	0.851
32	ability to facilitate recruitment*	1.88	2.09	,139	0.824

Notes:
significant difference: - p< .05
ϱ=,80-1,0 "Very strong"
Source: our own research (2022)

5. Discussion

It can be said that the most expected competencies (RQ1) are positive attitude, agility, motivation, openness to innovation and change, time management (for work), the ability to use software and IT tools, curiosity, ensure cross-department cooperation, creativity. These required competencies mirror the dynamic changes of the environment, which requires flexibility and quick adaptation from employees. Furthermore, the computer skills became extremely important due to the digital transformation of the whole economy.

The least expected qualities are mainly leadership qualities, such as ability to train people, ability to make forecasts (financial, dividend, economic trends), management skills, ability to build professional networks, ability to create contracts, ability to facilitate recruitment. In our opinion, these competencies can best be developed at work and fresh graduates usually do not start as managers, so these abilities are not expected anyway from them.

Regarding the experienced competencies (RQ2), the students show the best performance in ability to use software and IT tools, curiosity, positive approach, agility and openness to innovation and change. Important result, that self-confidence is also relatively strong. On the one hand, the relatively high value of self-confidence might mirror a negative opinion from the employer side since they might feel baseless over-confidence from the students sometimes. On the other hand, it might be a good sign since the Hungarian education traditionally emphasize the mistakes and lacking instead of strengthening the good values of students.

Based on the significance test, except for six competencies (ability to facilitate recruitment, administrative skills, self-confidence, ability to make forecasts, ability to create contracts, ability to build professional networks), there is a remarkable difference between expectations and experiences (RQ3). The average deviation is 0.75. Only in the case of the ability to facilitate recruitment is experience better than expectations (but not significantly). The values of the correlation indicators show a very strong relation between the two categories, which confirms the adequacy of the developed competencies to market expectations. In other words, even if there are significant differences between expectations and experiences, still the more expected competencies are better than the less expected ones.

However, the significant differences draw attention to the fact that the degree of development must be adjusted to market expectations with greater emphasis. The most expected competencies (up to a value of 4) are mostly soft skills, which are more difficult to develop in training. Native and foreign language communication, complex mindset, systems approach, the use of software ability to analyse and IT tools are in our opinion, skills that can be developed in training and are not typical managerial competencies.

In the case of the complex mindset the huge deviation may, for example, be due to the structure of the education system, which treats each subject separately already in primary school and does not provide an opportunity to "cross-over" between them. At the university level, close cooperation with industry, e.g. by studying and working through specific cases, problems and questions, and applying a complex mindset to answer them, with systems approach, can help to replace this approach. This is why the case study is very popular as a teaching methodology tool in many cases. It also plays an important role in the competency development of the future logisticians, since an example from life/industry can also help to a great extent to meet the expectations showing the greatest deviation come to the fore in our research. The situations described in the case studies are therefore very important, because they allow students to get to know the tasks they are facing and during their solution they can develop the necessary competencies such as complex mindset, ability to use IT tools, ability to plan and analyze, risk assessment skills, time management, communication skills.

A weakness of the research is that it did not differentiate between the level of the positions held, because the position was not the subject of the research, it only asked for the general opinion of the regional managers about the master's degree students. We did not investigate the

competencies of bachelor's degree graduates or whether managers could/would differentiate between BA/MSc. The focus was on the positions that a recent graduate could fill in the given field. As further research directions, among qualitative methods, interviews and focus group discussions are possible within and between all three stakeholder groups.

6. Conclusion

In this paper we have shown, based on an online survey of 72 Hungarian supply chain managers what are their expectations of freshly graduated students and what reality they see.

It has been confirmed and is extremely important that soft skills are progressively becoming a requirement, more and more valued compared to professional knowledge, and that competency expectations are constantly changing. Hard skills are treated by employers as obvious or quick to learn. The development of appropriate competencies has become an essential element of both management and the organization of higher education. One of the tangible proofs of this is the competencies that can be found in the exit criteria of each course, which students need to possess to graduate.

The increased interest in SCM education and the changing environmental factors suggest that existing cooperation needs to be maintained, deepened, and expanded to ensure further relevant SCM education. The aim is therefore to train a "marketable" student, which entails the reorganizing of the training structure, the redefinition of the training output requirements, and the rethinking of the roles of professors.

Furthermore, social and economic changes require new competencies, which will call for a continuous review of the subject in the future.

This is why it is important that the educational system and, beyond that, the graduates meet these expectations as much as possible. The economic impact of logistics requires the use of more effective teaching methods, such as interactive learning, group projects, internships, periodical collaboration, etc. – which allow students to solve realistic problems independently, which deepens the acquired knowledge -, of which Munkácsi, Demeter, (2019) provides a more detailed overview. We note that logistics must be constantly reinterpreted over the years. For this reason, it is important that educational methods adapt to the changing industrial environment.

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The Basic Psychological Need Satisfaction and Frustration of Lecturers and Staffs' Ho Chi Minh University of Social Sciences and Humanities in Covid-19

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Abstract

The COVID-19 pandemic has affected several aspects in life globally such as studying, working, recreation and so forth. However, people all over the world still need to keep life going on by one way or another. Especially education should be maintained under certain adverse circumstances. Teachers and institutional staffs are working multiple times harder not only to give lessons to students but acomplish various tasks besides work simutaneously. This may lead to stress and other mental health problems as a result. The purpose of this survey was to explore the reality of the basic psychological need satisfaction and frustration of them. Using the conceptual framework of quantitative research, a survey was conducted in Ho Chi Minh University of Social Sciences and Humanities among lecturers and staffs with 147 participants on October 2021. Internal coefficient and exploratory factor analysis were performed to examine reliabilty and validity of the measure, decriptive analysis was used to determine means of basic psychological need satisfaction and frustration among lecturers and staff; t-test and ANOVA were calculated to examine the differences in the need satisfaction and frustration among sociodemographic variables. The results showed that the basic need satisfaction and frustration scale was valid and a six-factor solution fitted the data in Vietnamese context. Basic psychological needs satisfaction (M = 3.71, SD = 0.52) is higher than basic psychological needs frustration (M = 2.63, SD = 0.65) of participants during COVID-19 pandemic. The sub-scale of each need satisfaction and need frustration varied with the sociodemographic charateristics. The implications of the results and limitations are also discussed.

Keywords: the basic psychological need, satisfaction, frustration, lecturers and staff in HCMUSSH, COVID-19, education.

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1. Introduction

The modern world has experienced considerable changes since the Covid-19 pandemic started in Wu-Han city of China. The detrimental influences of Covid-19 have impacted on economy (Topcu, Gulal, 2020), transportation (Maital, Barzani, 2020) health system (Susilawati et al., 2020), human well-being (WHO, 2020) and Education system (Tarkar, 2020) in every nation and global in general. That is a reason why Covid-19 is not just a public health crisis (WHO, 2020). Particularly, for managing the spread of Covid-19, Education institution has been tremendous changed around the world. Schools in Covid-19 have been "Closed" and changed formal of learning and teaching: Online, Offline or Mix On-offline, etc.

Vietnam has suffered 4 waves of Covid-19 pandemic since the first case of founded on January 2020. At "Lock down" time, the formal of education changed day by day made enormous pressure for educators. According UNESCO and UNICEF' report (2021), although (From April 2020) Ministry of Education and Training in Vietnam (MoET) has attempted to growth educators for coaching Information and Communications Technology (ICT) while schools were closed, educators still have faced challenges. There are lacks of practice with, access to technological education. In Addition, Educators have "quickly shifted to remote learning are complex, and require established skill sets" (UNESCO and UNICEF, 2021) while the policy of social distance of Vietnam were changed day by day. They have made educators to increase stress as a one educator have shared: "I feel under pressure. To prepare for a one 45-minute teaching period, I have to have two days of preparation" (According UNESCO and UNICEF, 2021). Besides that, educators have also faced numerous of problems in their life. It could be from their family (their parent, their children, their partner…), their community or their individual (salary, work style, house work, etc.). There are reasons why educators might be "forgot" with their basic psychological. After a fourth wave of Covid-19, Vietnam has opened with the new police called "new normal" since October 2021. Education system and educators have started "new normal." For all the above rationale, they make our concern to understand about the basic psychological need satisfaction and frustration of people who worked in education environment in general and especially lecturers and staffs in Ho Chi Minh University of Social Sciences and Humanities (HCMUSSH) in which we have learned and worked after Covid-19 pandemic.

By using quantitative approaches, this study is aimed to (1) explore the satifaction and frustration of basic psychology needs of lecturers and staffs in HCMUSSH during the lockdown period; and (2) examine the differences in satisfaction and frustration with basic psychological needs among different demographic groups such as gender, health status, income, and seniority.

2. Theoretical framework

Basic Psychological Needs

It is a generally acknowledged fact that the basic psychological needs in human being could be divided into 3 types of needs. These are autonomy need, relatedness need and competence need (Deci, Ryan, 2000; Hackman, Oldham, 1976; Vansteenkitste et al., 2005; Schutte, Malouff, 2018; Baumeister, Leary, 1995; Reis, 1994; Ryan, Deci, 2017). And it ought to stress that basic psychological needs are an essential for the human being toward well-being. During this perspective, the human of nature needs to be satisfied with psychological needs that similarities to providing the nutrients the body to function, synthesize, and contribute to physical and mental health (Chen et al., 2015). In sharp contrast, the basic psychological needs frustration could affect negative to physical and mental health of human such as hopeless, disconnect with others, lower self-esteem, etc. (Deci, Ryan, 2000; Hackman, Oldham, 1976; Vansteenkitste et al., 2005; Schutte, Malouff, 2018; Baumeister, Leary, 1995; Reis, 1994; Ryan, Deci, 2017).

The present study

To recapitulate, our research presents the reality of basic psychological need satisfaction and frustration of lecturers and staffs in HCMUSSH.

Sample and instrument

Sample

Participants have been taken part in our research should be lecturers and staffs in HCMUSSH. During October 2021, the structural survey has been sent to participants by email and the data has been collected by Google Form. The content online survey includes an introduction and aims of research, the study objectives, issues of ethical research (anonymous and voluntary action), demographic questions and related scale. We should ignore participants who do not agree

about condition research and do not complete all content of survey. A convenient sample in this study has been calculated by Green's Formulation (Tabachnick, Fidell, 2012): N ≥ 50 + 8p with N = size of sample and p = the number of independent variables. In this study, the survey has 6 independent variables: satisfaction and frustration with autonomy need, competence need and relatedness need. So, the sample size must be at least 98. In the present study, data have been constructed by 147 participants who are a lecturer or staff in HCMUSSH. The demographic characteristic of participants has been shown in Table 1.

Table 1. The research samples (n = 147)

Variable	Group	N	%
Gender	Male	47	32
	Female	100	68
Seniority	Under or at least 5 years	43	29.3
	From higher 5 to 10 years	45	30.6
	From higher 10 to 15 years	40	27.2
	Higher 15 years	19	39.5
Health Status	Good	58	39.5
	Normal	72	49
	Have problem or some problems health	17	11.6
Incomes	Under or at least 10 million Vietnam dong	79	53.7
	From higher 10 to 15 million Vietnam dong	42	28.6
	Higher 15 million Vietnam dong	26	17.7

Research tools

Basic Psychological Needs Satisfaction and Frustration Scale (BPNSFS)

The BPNSFS was developed by Chen et al. (2015). The scale was adapted to Vietnames context by Cat Tuong Nguyen Phuoc (2020). In this scale, there are total of 24 items in form of 5-point Likert scale, ranging from 1 (Completely Disagree) to 5 (Completely Agree) measuring 6 factors: (1) Satisfaction about Autonomy need; (2) Frustration about Autonomy need; (3) Satisfaction about Competence need; (4) Frustration about Competence need; (5) Satisfaction about Relatedness need and (6) Frustration about Relatedness need. The Cronbach alpha for autonomy, relatedness, and competence satisfaction were 0.69, 0.77 and 0.81 respectively (Chen et al, 2015). In the current study, Cronbach alpha coefficient was found to be 0.79, 0.82, and 0.78 for satisfaction of autonomy, relatedness, competency needs sub-scale respectively. For frustration scales of these needs, the Cronbach alpha coefficient was, respectively, 0.86, 0.76, and 0.80.

Table 2. Reliability of the scale (n = 147)

No	Scale	No item	Cronbach's Alpha	Corrected item – Total Correlation
1	Satisfaction with Autonomy need	4	0.79	0.533 – 0.698
2	Frustration with Autonomy need	4	0.86	0.616 – 0.771
3	Satisfaction with Relatedness need	4	0.82	0.568 – 0.760
4	Frustration with Relatedness need	4	0.76	0.550 – 0.628
5	Satisfaction with Competence need	4	0.78	0.549 – 0.631
6	Frustration with Competence need	4	0.80	0.527 – 0.706

The scale was created for the purpose of computing the average score with different aspects. Higher scores taken from the satisfaction scale indicate higher satisfied feeling while higher scores taken from the frustration scale indicate higher frustrated feeling to the basic psychological needs. In a 5-point Likert scale, the interval between each level is 0.8 points. The range of levels is determined by the formula (n-1)/n = 0.8. The significance of the mean values is determined in the following manner:

- 1.00 – 1.80: Responders strongly disagree with statements regarding their expression of satisfaction or frustration with basic psychology needs
- 1.81 – 2.60: Responders disagree with statements regarding their expression of satisfaction or frustration with basic psychology needs
- 2.61 – 3.40: Responders partially disagree with statements regarding their expression of satisfaction or frustration with basic psychology needs
- 3.41 – 4.20: Responders agree with statements regarding their expression of satisfaction or frustration with basic psychology needs
- 4.21 – 5.00: Responders strongly agree with statements regarding their expression of satisfaction or frustration with basic psychology needs

Statistical Analysis

It should be stated from the outset that this study is a descriptive study. This research design was light-emitting diode to quantitative methodology. After collecting data process, data collected in Google Form has been used input data for The Statistical Package for Social Sciences (SPSS) 20.0 software. First and foremost, data cleaning process has been started (removing missing value). After that, SPSS has been used for data management and to find the significant statistical figures.

When the main data has been collected, we have tested the vadility and reliability of BPNSFS via Cronbach's alpha coefficient and exploratory factor analysis (EFA). The BPNSFS in our research to see six factors like the origin of BPNSFS in Chen et al (2015) study. In our BPNSFS, the KMO and Barlett's test (0.737 – $p < 0.05$) and Eigenvalue = 1.129 demonstrated 67.879 % total variance explained. Besides that, there could be explain Factor loading have been presented in Table 2.

Analysis of variance (ANOVA) and *t*-test were used to test statistical differences among sociodemographic characteristics. We looked at p-value to determine whether two or more populations are statistically different from each other.

Table 3. The factor loading of BPNSFS

Items	Autonomy need		Relatedness need		Competence need		Cronbach's α
	Satisfaction	Frustration	Satisfaction	Frustration	Satisfaction	Frustration	
I feel like I am free to decide for myself how to live my life	0.517						
I pretty much keep to myself and don't have a lot of social contacts	0.817						0.792
Most days I feel a sense of accomplishment from what I do	0.734						
I feel I have been doing what really interests me	0.694						
Most of the things I do feel like "I have to"		0.810					
I feel forced to do many things I wouldn't choose to do		0.729					0.868
I feel pressured to do too many things		0.799					
My daily activities feel like a chain of obligations		0.770					

I feel that the people I care about also care about me	0.689				
I feel connected with people who care for me, and for whom I care	0.830				
I feel close and connected with other people who are important to me	0.683				0.817
I experience a warm feeling with the people I spend time with	0.709				
I feel excluded from the group I want to belong to		0.682			
I feel that people who are important to me are cold and distant towards me		0.760			0.764
I have the impression that people I spend time with dislike me		0.790			
I feel the relationships I have are just superficial		0.556			
I feel confident that I can do things well			0.709		
I feel capable at what I do			0.678		
I feel competent to achieve my goals			0.705		0.781
I feel I can successfully complete difficult tasks			0.864		
I have serious doubts about whether I can do things well				0.706	
I feel disappointed with many of my performances				0.700	
I feel insecure about my abilities				0.655	0.805
I feel like a failure because of the mistakes I make				0.780	

3. Results

When we have used the BPNSFS for 147 participants who are the lecturers and staff in HCMUSSH, there were several significant results. The most outstanding feature is the basic psychological needs satisfaction (M = 3.71, SD = 0.52) is higher than basic psychological needs frustration (M = 2.63, SD = 0.65) of participants in Covid-19 pandemic. In Addition, the score of small factors have demonstrated the rationality of statistical figures calculated (see Table 4).

The level of satifaction with basic needs falls within the range of 3.45 to 3.92, indicating general agreement with these three fundamental needs. When it comes to assessing satisfaction in these areas, lecturers and staffs mostly express a positive sentiment about their competence while working during the lockdown period, followed by related need and autonomy need. While the level of frustration with these three basic needs falls into the range of somehow agree with the needs. Lecturers and staffs tend to be frustrated with autonomy need (M = 3.05), followed by their competence need and related need.

The statistical figures of the basic psychological needs satisfaction of HCMUSSH lecturers and staff in Covid-19 have “fluctuations” when they have been combined with demographic characteristic of participants. As can be observed, the statistical data on Table 5 had recorded the variable of the demographic characteristics of participants such as sex, seniority, health status and incomes have

increasing significant statistics (T-test and ANOVA Test) the different between each group about satisfaction with the basic psychological needs. Particularly, man have argued the basic psychological needs (M = 3.53, SD = 0.56) higher than female (M = 3.53, SD = 0.48). As far as same way, the group of the highest incomes (M = 3.79, SD = 0.48) is the highest score in the group of incomes. As a rule, it also demonstrated scores on the group of "the lowest incomes" measure (M = 3.62, SD = 0.54) were the lowest. However, it is interesting note that the variable in demographic characteristic of participants such as "seniority" and "health status" did not provide significant the figures calculated about satisfaction with the basic psychological needs of HCMUSSH lecturers and staff in Covid-19.

Table 4. The basic psychological needs satisfaction and frustration of HCMUSSH lecturers and staffs in Covid-19

Needs	satisfaction		frustration	
	M	SD	M	SD
Autonomy	3,45	0,67	3,05	0,89
Relatedness	3,77	0,74	2,37	0,77
Competence	3,92	0,59	2,47	0,79
Basic psychological needs	**3,71**	**0,52**	**2,63**	**0,65**

Table 5. The basic psychological needs satisfaction in Covid-19 sort by demographic characteristic of HCMUSSH lecturers and staffs

Demographic characteristic		M	SD	t- or F-statistics	p	Comparison
Sex	Male (M1)	3.53	0.56	-3.07	0.003*	M1 < M2
	Female (M2)	3.80	0.48			
Seniority	Under or at least 5 years (M1)	3.71	0.56	0.76	0.519	M1 = M2 = M3 = M4
	From higher 5 to 10 years (M2)	3.72	0.54			
	From higher 10 to 15 years (M3)	3.64	0.48			
	Higher 15 years (M4)	3.86	0.43			
Health Status	Good (M1)	3.78	0.49	1.12	0.330	M1 = M2 = M3
	Normal (M2)	3.69	0.54			
	Have problem or some problems health (M3)	3.57	0.55			
Incomes	Under or at least 10 million Vietnam dong (M1)	3.62	0.54	4.94	0.008*	M1 < M3 M1 = M2 M2 < M3
	From higher 10 to 15 million Vietnam dong (M2)	3.73	0.45			
	Higher 15 million Vietnam dong (M3)	3.97	0.48			

Notes: *p< 0.05

In a sharp contrast, the statistical figures of the basic psychological needs frustration in Covid-19 sort by demographic characteristic of participants mentioned above the juxtaposition of the tendency. The statistical data on Table 6 has showed the significant relation between the basic psychological needs frustration and "seniority" and "health status" variable in demographic characteristics' factor. Particularly, in our research, lecturers and staffs who have more than 15 years in HCMC have frustrated the basic psychological needs were the highest (M = 2.96, SD = 0.66). It is an evident for a tendency: the more seniority, the more basic psychological needs frustration in Covid-19. Besides that, it is

delightful to note that participants who have good health have frustrated the basic psychological needs (M = 2.76, SD = 0.72) were higher than the participants have a health problem.

Table 6. The basic psychological needs frustration in Covid-19 sort by demographic characteristic of HCMUSSH lecturers and staffs

Demographic characteristic		M	SD	t- or F-statistics	p	Comparison
Sex	Male (M1)	2.57	0.58	-0.81	0.418	M1 = M2
	Female (M2)	2.66	0.68			
Seniority	Under or at least 5 years (M1)	2.43	0.64	3.54	0.016*	M1 = M2 M1 < M3 M1 < M4 M2 = M3 M2 < M4 M3 = M4
	From higher 5 to 10 years (M2)	2.59	0.65			
	From higher 10 to 15 years (M3)	2.74	0.8			
	Higher 15 years (M4)	2.96	0.66			
Health Status	Good (M1)	2.76	0.72	3.38	0.037*	M1 > M3 M2 > M3 M1 = M2
	Normal (M2)	2.61	0.55			
	Have problem or some problems health (M3)	2.30	0.71			
Incomes	Under or at least 10 million Vietnam dong (M1)	2.60	0.55	1.69	0.193	M1 = M2 = M3
	From higher 10 to 15 million Vietnam dong (M2)	2.52	0.63			
	Higher 15 million Vietnam dong (M3)	2.89	0.88			

Notes: *p < 0.05

4. Discussion

Basic psychological needs could be widely introduced in Western countries but it is relatively new in South East Asia. So far, there is research by Cat Tuong Nguyen Phuoc with attempt to validate BPNSFS in Vietnamese context for adolescents. The finding of this study showed that the scale was reliable and valid within Vietnamese context for adult version although reliablity of the scale for adolescent version was unsatisfactory according to study of Cat Tuong Nguyen Phuoc (2020). However, this study also confirms that these needs are relavent to anyone as proposed by Ryan & Deci (2000).

In descriptive analysis, we find that the basic need satisfaction was higher than basic need frustration during the quarantine. Howerver, we did find that the need satisfaction and the need frustration during this critical period were varied along the sociodemographic characteristics (gender, seniority, health status, and incomes) via t-test and ANOVA. It indicated tendency that "the healthier, the more frustration" lecturers and staff get during the lockdown restriction. The result could be one of resources of global study during COVID-19 pandemic.

5. Limitation

It should be emphasized that our research may be the second study using BPNSFS after Cat Tuong's study (2020). The investigation of our study is adapting and validation BPNSFS in context of Vietnam society and culture. Addition, our study may be the first study using BPNSFS for objective research who are educators. Besides that, our study has some limitations. First, the study is a descriptive study. It makes our research difficult to understand the reason made participants satisfied (or not) the basic psychological need deeply. Future research may consider qualitative information or changes the quantitative research model. Finally, the Basic Psychological Needs

Satisfaction and Frustration Scale have been continued to standardization process in Vietnam. So, this can be the way for future studies.

6. Conclusion

Our research has presented that although COVID-19 pandemic impacted on facets to life, lecturers, and staffs in HCMUSSH have satisfied with the basic psychological need higher than have frustrated. Amazingly, in our study, we could find significant statistical about healthy status of participants affected the basic psychological need frustration. It indicated "the healthier, the more frustration" tendency.

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Preschool Teachers' Perception of the Effect between the Principal's Support, Quality of Interpersonal Relationships and Loyalty of Employees in Preschool Institutions

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Abstract

Principal's support is an unquestionable component of preschool institutions, especially in the development of interpersonal relationships, which have to be the foundation for building cooperative culture, learning communities and caring environments where the youngest generations grow and learn. Numerous researchers have examined the issue of the principal's support in attaining the success of preschool institutions, satisfaction of employees and the growth of professional communities. However, there is little research into the significance of the principal's support for quality interpersonal relationships in preschool institutions, especially in Croatia. Therefore, this research focused on the correlation between the support from principals and the quality of interpersonal relationships and employees' loyalty. The aim of the research was to examine the effect between the principal's support, the quality of interpersonal relationships and the loyalty of employees through the perception of pre-school educators in Croatia. The research was conducted on a sample of 332 preschool educators in the Republic of Croatia. The following scales were used: The principal Support Scale, School Loyalty Scale and Faculty Survey, which were modified for this study. Using SEM, a partial mediation model (no recursive model) was confirmed. The effect of the mediation variable loyalty to the institution in the relationship between the principal's support and the quality of interpersonal relationships was proven. The partial mediation model in SEM indicates that the principal's support through employees' loyalty to the kindergarten has a positive effect on the quality of interpersonal relationships.

Keywords: principal's support, devotion to kindergarten, quality of interpersonal relationships, preschool educators.

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1. Introduction

The quality of a preschool institution's work greatly depends on interpersonal relationships, mutual synergy of its dynamics and on the support provided by the principal. The key role of the preschool institution's principal is to secure continuous professional education, quality working conditions and develop beneficial interpersonal relationships. Schmidt-Davis and Bottoms (2011) have found that the success of educational institutions is not achieved by employees or principals alone, but is achieved through harmonious and joint functioning of all the stakeholders within institutions. Numerous researchers (Branch et al., 2013, Simkin et al., 2010, Terek et al., 2015) whose research was focused on examining the correlation between interpersonal relationships and students' school achievement fond that institutions where principals create a positive working environment are more successful than those where such cooperation is lacking. Hull (2012) stressed that the support from the principal as key in attaining the prosperity of educational institutions. Hull (2012) stressed that encouraging cooperation between all employees, providing constructive feedback, monitoring the work and joint evaluation, and developing incentive atmosphere are key characteristics for the development of quality interpersonal relationships. Institutions with such atmosphere will surely accommodate for full development of each of its stakeholders. Leithwood (1994) suggested that principals with a clear sense of direction have the greatest influence on their employees and r achieving success regarding overall functioning of the institution. If principals encourage mutual understanding of the institution with its goals and activities, this becomes the foundation for creating the sense of purpose or vision. Building a joint vision and achieving a common goal help raise the awareness of employees about the goal and purpose of their functioning and work, which in turn helps them to create their own personal, whereby also, collective identity. Principals who strive for a positive atmosphere develop a supportive organisational structure where all stakeholders have the opportunity to express their opinion, integrate changes and, in doing so, positively influence the culture of the institution. Barnett and McCormick (2004) have found in their research a positive correlation between the principal's leadership style and school culture.

The concept of culture helps people in creating new ways of learning, with the imperative of sustainable reforms (Fullan, 2005). Regarding the success of educational reforms, the same researcher (Fullan, 2007; Fullan, 2010, as cited in Kokanović, 2021) accentuated the significance of cooperative communities and accentuates the principal's role in developing the professional cooperative community. If the principal secures adequate conditions and support for cooperation with external stakeholders, and applies desired strategies for empowering cooperation, the quality of cooperative relationships within the institution will rise accordingly. Positive working environment or atmosphere is a predictor of successful functioning and growth of interpersonal relationships within the preschool institution. Positive atmosphere is characterised by humane relationships and mutual trust of employees within institutions. Brust Nemet and Velki (2016) stated that atmosphere is a significant factor influencing the development of pedagogic qualities and self-confidence of education workers, the quality of their work and interpersonal relationships. On the other hand, Tschannen-Moran and Woolfolk Hoy (2007) underlined that negative atmosphere decreases the sense of self-efficacy in preschool teachers, and it is characterised by overload, lack of work recognition, low salaries, poor interpersonal relationships, professional isolation, insecurity and estrangement. In line with the stated, every aware and competent principal strives for the development of positive atmosphere and quality interpersonal relationships in order for the preschool institution to function successfully.

Prosperous preschool institution is characterised by participation of all stakeholders, them taking part in decision-making, sharing responsibilities, collegiate relationships and devoted work and loyalty. Such institutions actively reflect upon and change educational practices in accordance with development and needs of their employees and in such a way become productive and efficient. Already in the nineties of last century, Levine and Lezotte (1990) pointed out that a productive and successful institution is characterised by its employees' devotion and their directedness toward realising a common goal, constructive problem solving, cohesion and cooperation, team work, mutually appreciative communication, joint decision making and recognising achievement and promotion in the work. Fullan and Quinn (2016) stressed that the power of a group can also be misdirected, because coming together without collective reflection can be a big waste of time. People need time to process, think about and integrate different sources of information on their competence (Bandura, 1977). Therefore, collective efficacy of preschool teachers does not happen

overnight, which denotes some limits of this research. Only after high efficacy expectations are developed, through repeated success, can we reduce the (probable) negative effect of preschool teachers' failure (Bandura, 1977). Kindergartens must therefore implement and motivate collective efficacies by prioritising at the very beginning of the school year, if they want to reap the benefits. Not only that the awareness of elasticity is required but coordination is also demanded, and significant efforts need to be invested in order to start a change (Donohoo, 2017).

Loyalty to an institution has found its way into the focus of many studies because it is considered a significant predictor of positive working environment, work ethics and work results (Luchak, Gellatly, 2007; Meyer et al., 2012). Kristof-Brown and Guay (2011) stated that employees who manifest loyalty to their institution are more motivated, more satisfied with their job and more dedicated to work, whereby more efficient. Individuals expresses their loyalty and devotion to an institution and/or persons alongside who they feel personal growth, development and belonging Meyer and Allen (1991) describe loyalty as a psychological state with at least three separate components, i.e. desire (affective loyalty), need (instrumental loyalty) and obligation to keep job in the organisation (normative loyalty). Meyer and Allen (1991) claim that affective loyalty is manifested as the feeling of dedication and preoccupation with the institution one works at. Instrumental loyalty ensues form the awareness about the consequences of abandoning the workplace, while normative loyalty is founded in the obligation to stay in the workplace. Individuals with pronounced normative loyalty remain faithful to the workplace and their organisations because they feel it is morally the right thing to do.

Despite ubiquitous awareness about the significance of quality interpersonal relationships acting as a predictor of successful functioning of institutions, numerous studies in the world and also in Croatia still show that the lack support from principals, which mostly results in negative atmosphere, poor interpersonal relationships, whereby also the stagnation and decrease of overall institution's quality. Furthermore, greater number of studies heretofore examined school principals, so this research focused on the principals of preschool institutions in Croatia. In line with this fact, the present research focused on examining preschool teachers' perceptions of the effect of the principal's support on the quality of interpersonal relationships, and determining the mediating role of loyalty to the institution as a mediating variable. Numerous researchers (Admiraal et al., 2016; Vanblaere, Devos, 2016; Walker, Hallinger, 2016) have pointed out to indispensable principal's support when dealing with professional development of employees and cooperative learning. Furthermore, the research on work motivation of preschool teachers stresses that institutions with principals who support their psychological needs positively affect motivation, welfare and efficiency of their employees (Kovjanic et al., 2013, Van den Broeck et al., 2016). The results of research by Ebersold et al. (2019) show that satisfying the need for autonomy amongst employees acts as mediator between the principal's support and autonomy and life satisfaction of employees. Hence, longitudinal analyses of successful restructuring of educational institutions point out that the characteristics of human resources such as openness to professional education, trust and respect, knowledge and skills, supportive leadership and socialisation are more important for the development of professional communities than structural conditions. The need for the improvement of culture, climate and interpersonal relationships in kindergartens is not getting enough attention (Kruse, Louis, 1994; Louis, Kruse, 1995; Newmann, Associates, 1996) Interpersonal relationships of employees is a significant link in creating adequate climate for efficient processes where one cannot forget loyalty, as one of the determinants of propelling desired changes. In short, the increasing number of case studies directs our attention to interesting but unattainable idea of social trust, as an important component of meaningful growth of educational institutions. In line with this, the present research sought to examine the mediating role of loyalty to the institution in the effect between the principal's support and the quality of interpersonal relationships due to lack of research on this construct in the mentioned relationship.

This research sought to answer the following questions:

- Is there a direct effect of the principal's support on the quality of interpersonal relationships?
- Does the employees' loyalty act as a mediation variable in the correlation between the principal's support and interpersonal relationships?

In accordance with the research questions, the following hypotheses were set:

H1: It is assumed that the principal's support has a direct effect on the quality of interpersonal relationships.

H2: Loyalty of employees is expected to act as a mediation variable in the correlation between the principal's support and the quality of interpersonal relationships. The assumption is that employees' loyalty acts as a mediator, that is, the principal's support influences the quality of interpersonal relationships via preschool teachers' loyalty.

2. Methodology

In this research, univariate and multivariate quantitative approach was utilised, which included descriptive and inferential statistics. Data collection was carried out among pre-school teachers through a questionnaire, and was carried out during May and June 2022, in online form. The survey questionnaire was sent electronically to principal's or representatives of educational associations in Croatia, after which a link with the survey questionnaire was sent to educators.

Sample

The research was conducted in Croatia on a random sample of preschool teachers in preschool institutions (N = 332). At its very beginning, the questionnaire provided information on the research aim, and the participants filled it out voluntarily and anonymously. In addition, they could give up on filling out the questionnaire at any given moment. The interview lasted 15 minutes. Most participants were female (N = 329). Distribution of the participants with regard to age was the following: younger than 30 years (N = 58), 31-40 years (N = 108), 41-50 years (N = 111), 51-60 years (N = 40), and older than 60 (N = 15). Considering the participants' years in service, 111 of them had 10 years of experience, 124 had 11-20 years in service, 61 had 21-30 and 36 participants had more than 30 years of work experience. The link with the questionnaires was sent to principals who shared it with preschool teachers and their groups and associations, also via the link.

Instrument and Procedures

The following scales were used to collect the data: Principal's Support Scale; Preschool Loyalty Scale (Meyer et al., 1993) and Faculty Survey (Tschannen-Moran, Hoy, 2003). The mentioned scales were adapted to this research.

Principal's Support Scale includes 16 items on four subscales: PS-professional support ("*He/she encourages my professional growth and development*."), ES-emotional support ("*He/she supports my decisions*."), ES-evaluation support ("*He/she gives me suggestions for improving my work*."), IS-instrumental support ("*He/she allows free days for professional education*."). The participants expressed the degree of agreement with the claims on a 5-point Likert scale ranging from 1-*I completely disagree* to 5-*I completely agree*. The scale's reliability was tested with internal consistency method according to Cronbach's Alpha model (α = .776).

Preschool Loyalty Scale includes 24 items on three subscales: AL-affective loyalty ("*Kindergarten I work in has a special meaning for me*."), IL-instrumental loyalty ("*If I left my job in this kindergarten now, many things would change in my life*."), NL-normative loyalty ("*Even if I got a better job offer, I would not leave this kindergarten*."). The participants expressed the degree of agreement with the claims on a Likert scale in range from 1-*I completely disagree* to 5-*I completely agree*. The reliability of the scale was tested via internal consistency method according to the Cronbach's Alpha model (α = .756).

Interpersonal Relationships Quality Scale includes 20 items distributed on three subscales: TC-trust in colleagues ("*Preschool teachers in our kindergarten do their work well*."), TPR-trust in the principal ("*Our kindergarten's principal is competent in his/her work*."), TPA-trust in parents ("*Preschool teachers in our kindergarten trust the parents*."). As on other scales, participants expressed the degree of their agreement with the claims in range from 1-*I completely disagree* to 5-*I completely agree*. The scale's reliability was tested via internal consistency method according to the Cronbach's Alpha model (α = .927).

3. Results

Multivariate inferential statistics approach, i.e. SEM (structural equation modelling) was used to test the hypotheses. Before testing the hypotheses, descriptive statistics of the scale were presented.

Table 1. Descriptive statistics

				Bootstrap[a]			
						95 % Confidence Interval	
		Statistic	Std. Error	Bias	SD	Lower	Upper
Affective loyalty	N	332		0	0	332	332
	Min	1,75					
	Max	5,00					
	M	**3,8581**	,03315	,0005	,0334	3,7914	3,9239
	SD	**,60402**		-,00035	,02544	,55603	,65395
	Skewness	-,627	,134	,009	,123	-,867	-,384
	Kurtosis	,296	,267	-,032	,334	-,349	1,006
Instrumental loyalty	N	332		0	0	332	332
	Min	1,25					
	Max	5,00					
	M	**3,1736**	,03510	-,0001	,0340	3,1118	3,2443
	SD	**,63948**		-,00126	,02517	,58939	,68844
	Skewness	-,170	,134	-,001	,119	-,405	,055
	Kurtosis	-,026	,267	-,015	,220	-,438	,400
Normative loyalty	N	332		0	0	332	332
	Min	1,00					
	Max	4,00					
	M	**2,8189**	,02576	-,0006	,0255	2,7681	2,8663
	SD	**,46943**		-,00021	,02142	,42762	,51334
	Skewness	-,515	,134	,018	,175	-,828	-,159
	Kurtosis	,854	,267	-,060	,512	-,154	1,789
Interpersonal Relationships Quality	N	332		0	0	332	332
	Min	1,55					
	Max	5,00					
	M	3,4023	,03788	-,0014	,0389	3,3214	3,4733
	SD	,69018		-,00025	,02455	,64192	,73584
	Skewness	-,283	,134	,001	,094	-,459	-,091
	Kurtosis	-,329	,267	,000	,155	-,608	-,002
Professional support	N	332		0	0	332	332
	Min	1,00					
	Max	5,00					
	M	**3,8441**	,06019	-,0031	,0627	3,7131	3,9563
	SD	**1,09671**		,00141	,04287	1,01569	1,18163
	Skewness	-,889	,134	,004	,096	-1,085	-,695
	Kurtosis	-,010	,267	-,005	,247	-,474	,505
Emotional support	N	332		0	0	332	332
	Min	1,00					
	Max	5,00					
	M	**3,6800**	,06410	-,0038	,0661	3,5498	3,8020
	SD	**1,16800**		,00111	,04370	1,07927	1,25335
	Skewness	-,786	,134	,004	,085	-,949	-,610
	Kurtosis	-,294	,267	-,001	,210	-,690	,156
Evaluation support	N	332		0	0	332	332
	Min	1,00					
	Max	5,00					
	M	**3,1845**	,06973	-,0019	,0722	3,0475	3,3252
	SD	**1,27062**		-,00106	,03373	1,20015	1,33053
	Skewness	-,263	,134	,003	,080	-,419	-,102

	Kurtosis	-1,088	,267	,006	,097	-1,247	-,869
Instrumental support	N	332		0	0	332	332
	Min	1,00					
	Max	5,00					
	M	**3,4315**	,06066	-,0017	,0631	3,3027	3,5550
	SD	**1,10530**		,00020	,03542	1,03589	1,17711
	Skewness	-,413	,134	,000	,080	-,571	-,260
	Kurtosis	-,633	,267	,002	,136	-,883	-,334
Valid N (listwise)	N	332		0	0	332	332

a. Unless otherwise noted, bootstrap results are based on 1000 bootstrap samples

In all subscales, mild left skewness of the distribution can be observed, in accordance with the increased values of MCT. Furthermore, sampling distributions vary from mostly mild kurtosis to mild leptokurtosis. All descriptive statistics are given in the bootstrapping (resampling) model which shows low values of standard deviations and bias, implicating reliable statistical parameters, i.e. estimated population values. The greatest arithmetic mean for the Preschool Loyalty Scale was obtained for affective loyalty subscale (M = 3.85; SD = 0.604), whereas the lowest assessments are visible on the normative loyalty subscale (M = 2.81; SD = 0.469). When examining loyalties, Cohen (2009) determined that affective loyalty increases when institutional climate provides employees with a chance to show and confirm their values, while Gellatly et al. (2006) underline loyalty as a positive predictor of work quality and responsibility of employees in relation to the institution. Considering higher assessments on the subscale of affective loyalty, which reflects devotion to the institution and desire for its development, and significantly lower assessments of normative loyalty, which encompasses the obligation to keep working due to existential issues, it can be concluded that institutions in which the research was implemented are on the verge of positive development and increase of their quality. On the Interpersonal Relationships Quality Scale, participants gave moderate assessments (M = 3.40; SD = 0.690), while on the Principal's Support Scale the highest assessments are given on the professional support subscale (M = 3.84; SD = 1.09), and the lowest are ascribed to the principal's support to evaluating their work and institution (M = 3.18; SD = 1.27).

To test the hypothesis, structural equation modelling in the bootstrap model was used. Figure 1 presents the direct effect of the principal's support on the quality of interpersonal relationships.

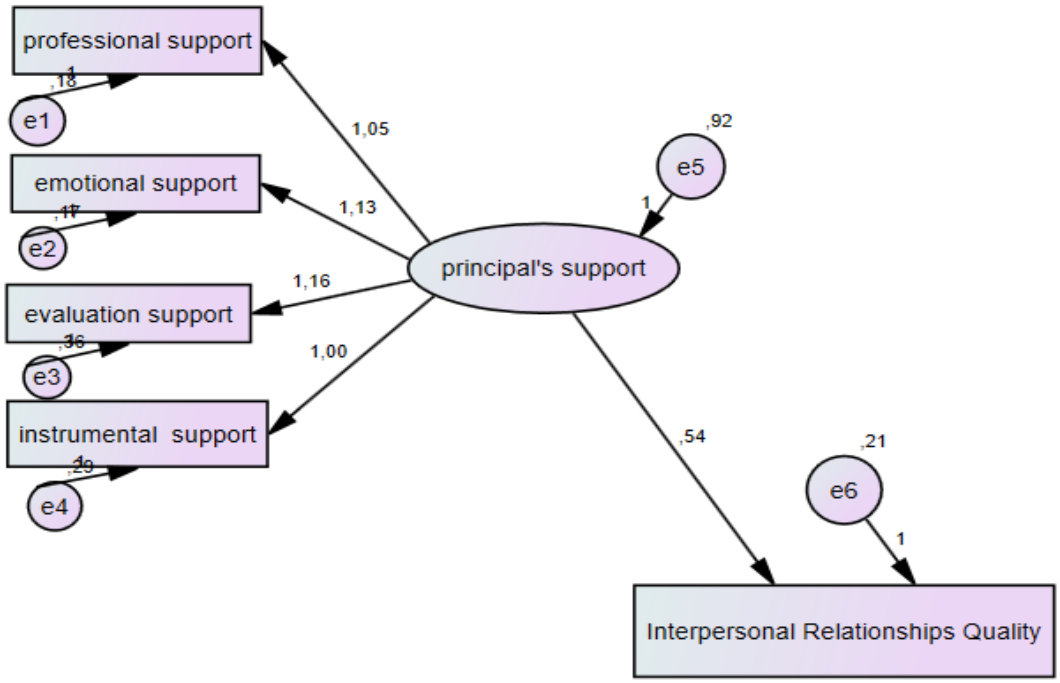

Fig. 1. The model of direct effect – unstandardized regression coefficients

The fit indices of the model of the effect of principal's support on the quality of interpersonal relationships are satisfactory: P CMIN/*df* = 2.977; NFI = 0.990; RFI = 0.981; IFI = 0.994; TLI = 0.987; CFI = 0.994; RMSEA = 0.077, PCLOSE = 1.33. Beta values and the levels of statistical significance (β = 0.54; p = 0.001) show that greater support from the principal effects better quality of interpersonal relationships. Autocorrelation in the residuals is not determined (Durbin Watson = 1,827) and collinearity also is not present ($VIF_{professional\ support}$ = 4,930; Tollerance = 0,277; $VIF_{emotional\ support}$ = 5,410; Tollerance = 0,185; $VIF_{evaluation\ support}$ = 3,792, Tollerance = 0,264; $VIF_{instrumental\ support}$ = 3,609, Tollerance = 0,277. This confirms H1. The correlation matrix is shown in Table 2.

Table 2. Correlations matrix

		Professional support	Emotional support	Evaluation support	Instrumental support	Interpersonal Relationship Quality
Professional support	Pearson Correlation	1	,876**	,799**	,793**	,693**
	Sig. (2-tailed)		,000	,000	,000	,000
	N	332	332	332	332	332
Emotional support	Pearson Correlation	,876**	1	,816**	,805**	,688**
	Sig. (2-tailed)	,000		,000	,000	,000
	N	332	332	332	332	332
Evaluation support	Pearson Correlation	,799**	,816**	1	,801**	,664**
	Sig. (2-tailed)	,000	,000		,000	,000
	N	332	332	332	332	332
Instrumental support	Pearson Correlation	,793**	,805**	,801**	1	,657**
	Sig. (2-tailed)	,000	,000	,000		,000
	N	332	332	332	332	332
Interpersonal Relationship Quality	Pearson Correlation	,693**	,688**	,664**	,657**	1
	Sig. (2-tailed)	,000	,000	,000	,000	
	N	332	332	332	332	332

**. Correlation is significant at the 0.01 level (2-tailed).

Figure 2 presents the model of the mediating role of loyalty to a kindergarten in the correlation between the principal's support and quality of interpersonal relationships.

The fit indices of the mediation model are: NFI = 0.962; RFI = 0.940; IFI = 0.971; TLI = 0.955; CFI = 0.971; RMSEA = 0.092, PCLOSE = 0.002. Fit indices are satisfactory, except RMSEA, so conclusions on the model's fitness should be given with caution. To test the mediating effect, Monte Carlo bootstrapping was applied (bias-corrected percentile method 2000 samples; confidence interval of 90). It is obviously that partial mediation took place since, after the introduction of the mediating variable, direct influence of exogenous on endogenous variables was still statistically significant (p = 0.001), with indirect effect confirmed (p = 0.001). Hence, the conclusion arises on the direct effect of the principal's support on the quality of interpersonal relationships, but also on the indirect effect of principal's support by mediation of employees' loyalty. Autocorrelation in the residuals is not determined (Durbin Watson = 1,824) and collinearity also is not present (VIF = 1,130-5,739; Tollerance = 0,174-0,885). This confirms H2. The correlation matrix is shown in Table 3.

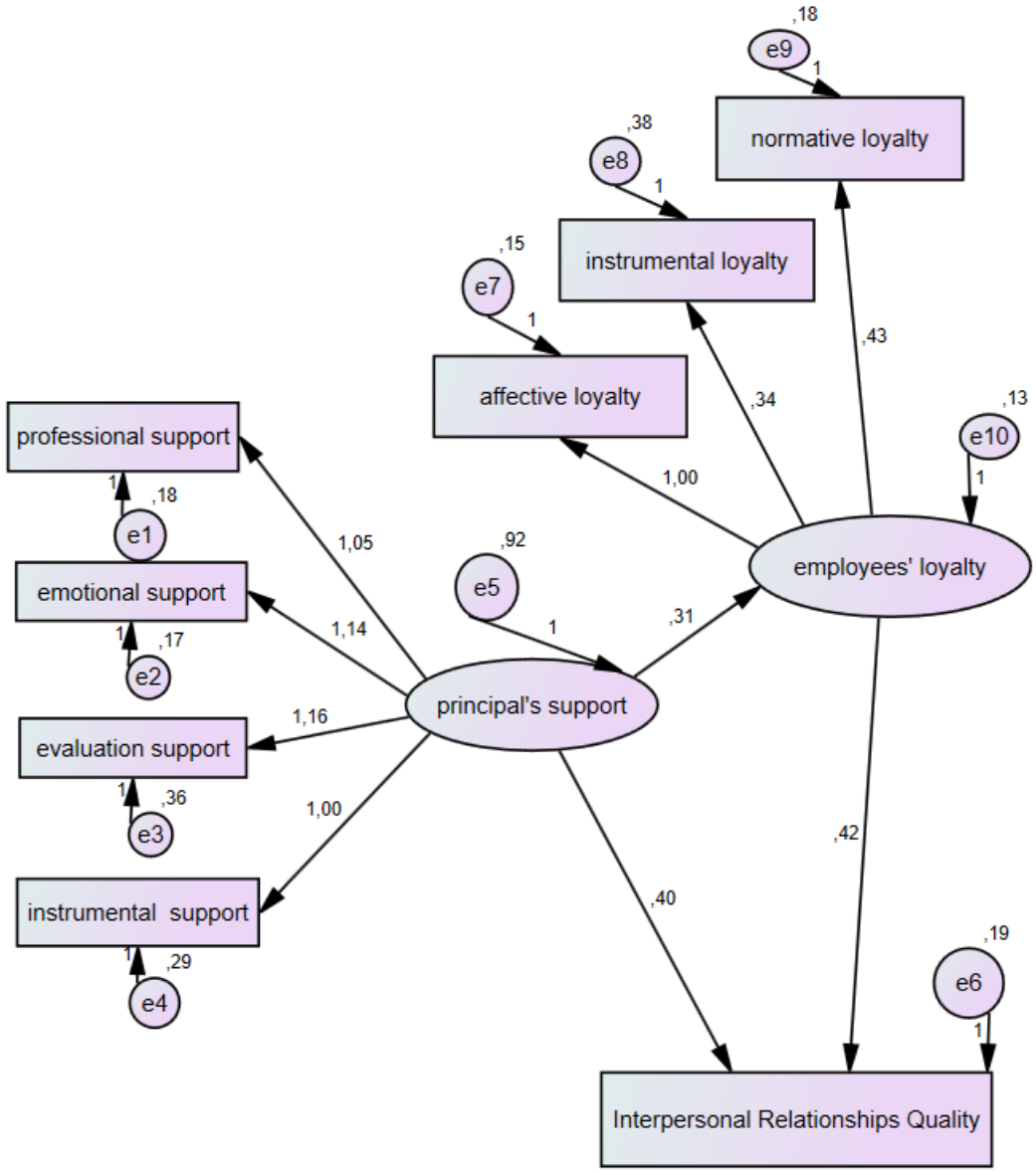

Fig. 2. Mediation model – unstandardised regression coefficients

Table 3. Correlations matrix

		Professional support	Emotional support	Evaluation support	Instrumental support	Affective loyalty	Instrumental loyalty	Normative loyalty	Interpersonal relationship quality
Professional support	Pearson Correlation	1	,876**	,799**	,793**	,439**	,072	,217**	,693**
	Sig. (2-tailed)		,000	,000	,000	,000	,188	,000	,000
	N	332	332	332	332	332	332	332	332
Emotional support	Pearson Correlation	,876**	1	,816**	,805**	,508**	,078	,234**	,688**
	Sig. (2-tailed)	,000		,000	,000	,000	,158	,000	,000
	N	332	332	332	332	332	332	332	332
Evaluation support	Pearson Correlation	,799**	,816**	1	,801**	,435**	,107	,330**	,664**

	Sig. (2-tailed)	,000	,000		,000	,000	,050	,000	,000
	N	332	332	332	332	332	332	332	332
Instrumental support	Pearson Correlation	,793**	,805**	,801**	1	,442**	,098	,252**	,657**
	Sig. (2-tailed)	,000	,000	,000		,000	,073	,000	,000
	N	332	332	332	332	332	332	332	332
Affective loyalty	Pearson Correlation	,439**	,508**	,435**	,442**	1	,173**	,310**	,513**
	Sig. (2-tailed)	,000	,000	,000	,000		,002	,000	,000
	N	332	332	332	332	332	332	332	332
Instrumental loyalty	Pearson Correlation	,072	,078	,107	,098	,173**	1	,327**	,103
	Sig. (2-tailed)	,188	,158	,050	,073	,002		,000	,060
	N	332	332	332	332	332	332	332	332
Normative loyalty	Pearson Correlation	,217**	,234**	,330**	,252**	,310**	,327**	1	,258**
	Sig. (2-tailed)	,000	,000	,000	,000	,000	,000		,000
	N	332	332	332	332	332	332	332	332
Interpersonal relationship quality	Pearson Correlation	,693**	,688**	,664**	,657**	,513**	,103	,258**	1
	Sig. (2-tailed)	,000	,000	,000	,000	,000	,060	,000	
	N	332	332	332	332	332	332	332	332

**. Correlation is significant at the 0.01 level (2-tailed).

4. Discussion

This research sought to gain insight into the preschool teachers' perception of the effect between the principal's support and the quality of interpersonal relationships and ascertain whether the loyalty of employees acts as a mediation variable in the mentioned correlation. The research results point to efficiency of principal's support in the development of quality interpersonal relationships with the mediation of employees' loyalty to a preschool institution. As a significant predictor of interpersonal relationships, loyalty should be developed and nurtured in individuals in order to strengthen cooperative relations, create healthy synergy in the institution and, finally, empower the overall institution. Similar results were obtained Kelly et al. (2005) in their research on the relationship between leadership styles and school atmosphere, wherein teachers positively assessed leadership and school atmosphere if principals showed consistency in their behaviours toward employees. Sorić et al. (2021) researched principals' burnout and concluded that the principal's support to the autonomy of employees leads to maintaining positive school climate. Their research shows that the greater the support from principals for their employees, the greater the support they themselves receive and, on the other hand, the lesser the burnout. Considering the field of the principal's work and the encompassed work tasks, the support for employees very frequently fails precisely for this reason, which firstly results in burnout and lack of support for employees in principals, and consequently in employees themselves. This is particularly noticeable in large institutions with even more than a hundred employees. This thesis was confirmed by Ozer's research (2013) which found that the principal's workload is significantly greater in large institutions, which consequently influences the climate, work motivation and overall quality. Park, et al. (2019) found in their research that support from principals positively influences learning communities and collective responsibility, which in return effects greater student achievement. Park et al. (2019) suggest that principals should pay more attention to supportive leadership, which can contribute to positive working atmosphere. A research by Adams, et al. (2017) on the principal's support to employees' autonomy and competence development, through students' perception, found great differences between schools where principals support teachers in developing positive atmosphere and care for the needs of their students in comparison to the schools where principals do not provide this type of support. In conclusion, the authors stress that students perceive principals who contribute to positive learning environments more positively, and they consider such environment supportive of autonomy and competence development. It is evident from the aforementioned that research on the principal's support has mostly been focused on schools, so these results can be considered significant for empowering preschool institutions as cooperative communities. On the other hand, a space is opened for future research on the specificities of cultural contexts in which each institution exists, providing a clearer

insight into the way interpersonal relationship function, since they are a complex but significant factor of pre-school institutions.

5. Limitations and conclusions

The results obtained in this research place accent on three significant components together (support, loyalty and quality interpersonal relationships) because they are inextricably linked in the preschool institution's functioning, that is, if any of them is decreased or lacking, the institution will not realize its full potential. The aim was to determine the correlation of the stated constructs, that is, to gain insight, from the preschool teacher's perspective, into the role of the principal's support in the development of quality interpersonal relationships and ascertain the mediation role of employees' loyalty. Structural equation modeling confirmed the direct effect of the principal's support on the quality of interpersonal relationships. Moreover, since statistical significance was still observable after the introduction of employees' loyalty as a mediation variable, it can be claimed that partial mediation took place, which confirms both set hypotheses. The results can be an indicator of what needs to be improved in order to achieve high-quality interpersonal relationships, which are a highly significant segment of the preschool institution's functioning. It can be inferred that complex and multidimensional systems such as preschool institutions require active participation of all key stakeholders, wherein the principal's support is especially important. Although the opinion of preschool teachers is significant, since they are the bearers of preschool institutions, a relatively small sample size can be regarded as a limitation of this study. Furthermore, the application of an exclusively quantitative approach can also be considered a limitation, considering that the entire functioning of a preschool institution is best investigated with a qualitative approach or a mixed approach. It would be desirable, apart from a larger sample, to cover a wider geographical area with the research. The subject of this research should also be examined from the perspective of principals, and within a longer time frame, wherein the development of institutions themselves would be investigated. Understanding the dynamics or leadership based of relationships requires a more in-depth and more quality approach, so this issue opens up a space for new research. In line with the stated, the implementation of qualitative monitoring and data collection methods, an in-depth analysis of all educational segments and opinions of all employees. In order for principals to secure constant support for their employees, they need to receive the same. As stated in this work, through the review of many studies, lack of support from the principal leads to decrease of work motivation, burnout and, with that, the drop in the quality of both interpersonal relationships and the preschool institution's functioning.

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Information Technology in Foreign Language Distance Teaching to Students of Technical Specialties

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Abstract

This article analyzes the applicability of information technology in Foreign Language distance teaching to students of technical specialties. The article reviews modern technology of Foreign Language distance teaching to students of technical specialties, exploring their advantages and disadvantages. The LMS (Learning Management System) is theoretically analyzed. The principles and features of educational courses developed on the Moodle platform are discussed. A set of English vocabulary and grammar exercises and tests is developed, using the distance learning technology of the «Distance Learning Technology Portal of Peter the Great St. Petersburg Polytechnic University». The experiment was conducted to confirm the effectiveness and feasibility of using distance learning technology based on the Moodle distance learning management system in the study of foreign language by first-year students of technical specialties of Peter the Great St. Petersburg Polytechnic University. Statistical analysis of the results of the post-experimental cross-section in the experimental and control groups was conducted, using Student's t-test. The article demonstrates the effectiveness of remote support for undergraduate students of non-linguistic specialties studying the basic course of English. It is concluded that it is expedient to include the Moodle distance learning system into the educational process.

Keywords: distance learning, information technology, foreign language, LMS learning management system, Moodle platform.

1. Introduction

In the modern world of information, foreign language teaching is increasingly implemented with digital technology and information resources.

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It is not a recommended, but an obligatory requirement in the system of modern education to use information technology in Foreign Language distance teaching to students of technical specialties (Meirovitz et al., 2022; Vinogradova et al., 2022; Murzo et al., 2019).

The relevance of the chosen topic is due to the lack of the required number of classroom hours for the study for foreign languages in the educational program for students of non-linguistic specialties. In this connection, it is rather problematic for students of technical areas of training to master foreign languages without the use of computer technology and information resources, including distance learning technologies (Saba, 2003; Gerasimova et al., 2022; Clement et al., 2017).

The research object is the process of teaching Foreign Language to students of non-linguistic specialties, including technical fields.

The subject of the research is the use of information technologies in distance learning of a foreign language for students of non-linguistic specialties.

The main purpose of this study is to test the effectiveness of the use of distance technologies in teaching students of technical specialties the discipline «Foreign Language».

In order to achieve the goals, the following tasks must be accomplished:

- to analyze the possibilities of using distance technologies in teaching the discipline «Foreign Language» to students of technical specialties;
- to conduct an experimental test of the effectiveness of teaching English to students of technical specialties based on the distance learning system Moodle.

2. Materials and methods

In the course of the study, the following methods were applied: an analytical review and generalization of scientific and methodological sources, observation, pedagogical diagnostics and reflection.

The Federal State Educational Standards for Higher Education states, that undergraduate students of technical and non-linguistic fields of study must have the following general professional and general cultural competencies:

- the ability to implement intercultural and communication based on written and oral communication;
- the self-education ability;
- the experience of using modern information educational technology, applied software for solving professional tasks;
- the ability to process and analyze information, using information and computer technology (Ovchinnikova et al., 2022; Varlakova et al., 2023; Samylovskaya et al., 2022).

Today, communication in a foreign language is becoming an increasingly essential component necessary for the future professional activities of graduates (Skornyakova et al., 2022; Mikeshin, 2022; Krainiukov et al., 2020). Thus, the role of the Foreign Language subject increases significantly, especially for undergraduate students of non-linguistic fields (Fandey, 2012).

Teaching foreign languages nowadays is practically impossible without the technical means and technology of distance learning (Folomkin i dr., 2022; Ignashchuk i dr., 2015; Polat, 2005).

The following procedures must be implemented in order to incorporate information technology for education:

- development of remote platforms providing learning opportunities;
- introduction of distance technology into the overall system of self-study;
- evaluation of the effectiveness of the use of distance learning technologies (Osipova, Goreva, 2014; Medeshova et al., 2022; Beloglazov i dr., 2017).

In modern education, information educational technology, including tools for distance learning support, has become widespread. For example, in Russia, more than 80 % of educational institutions effectively implement information educational technology for education and training (Shestakova et al., 2023; Ershova i dr., 2019; Krotova et al., 2019). Easy access and cost-effectiveness make these systems forward-looking learning tools (Gianelli, 2018; Bobkova, 2018).

Taking into account the studies, an analysis of the main advantages and disadvantages of modern training systems based on distance information technology was conducted (Kwary et al., 2018; Andrews, 2011; Bećirović et al., 2022). The analysis data are presented in Table 1.

Table 1. Advantages and disadvantages of the distance learning system

Advantages	Disadvantages
Personal approach (teacher can be in regular interactive contact with students, exchange information with students on various forums, webinars, in chat rooms)	Without direct supervision by the teacher, students may do less well
Versatility (opportunity to learn on-the-job)	Some specialties, such as medicine, are difficult and partially impossible to learn through a distance learning program
Flexibility (opportunity to learn at your own pace and at the right time)	There is no "live" communication between the teacher and students
Cost and time savings (reduced cost of travel to the place of training)	The content of distance learning courses does not always meet the learning objectives
Long-distance action (the ability to study does not depend on the location of educational institutions and residence of students)	The complexity of conducting practical classes and laboratory exercises

It can be seen from the Table 1 that, the use of remote support tools in addition to traditional teaching is reasonable and even necessary in today's world (Ponomarenko i dr., 2019; Vasin, 2016; Dabletova et al., 2017).

To implement distance support in addition to the traditional teaching of Foreign Language, modern educational technology implemented in various services are used: databases, portals; digital libraries and dictionaries; information and educational websites (Sveshnikova et al., 2022; Oblova et al., 2020; Kassymova et al., 2023).

The use of these services in the learning process has certain advantages and disadvantages (Table 2).

Table 2. Advantages and disadvantages of modern Internet technology

Advantages	Disadvantages
Diversity of material	Mismatch between the volume and complexity of information and the specific level of students
Increases the motivation of students.	Limited control over the learning process
Promotes the formation of information competence of students	Mismatch between these services and the objectives of the educational process
Helps develop students' independence	Redundancy of posted information

From Table 2 it follows that the Internet technology implemented in the above services can be used for training, but their use must be substantiated (Bersin, 2004; From, 2017; Ustyuzhanina i dr., 2018).

In contrast to the use of individual Internet services, the use of learning management systems such as LMS (Learning Management System) or educational platforms appears to be the most efficient, due to their lack of the aforementioned disadvantages. These systems were created purposefully to organize the educational process.

LMS is a universal platform. This platform performs the following basic functions:

- provides for controlling and registering user access to the learning content;
- produces reports on the results of training;
- gives students access to the learning portal in order to provide instructional content;
- provides a universal interface necessary for the learning process and teacher-student interaction;
- organizes communication between teachers and students;

This list shows that the LMS is a multipurpose system and implements quite a number of functions. LMS is just a platform which includes hardware and software as well as the organization of distance learning. Figure 1 shows the structure of the LMS (Learning Management System).

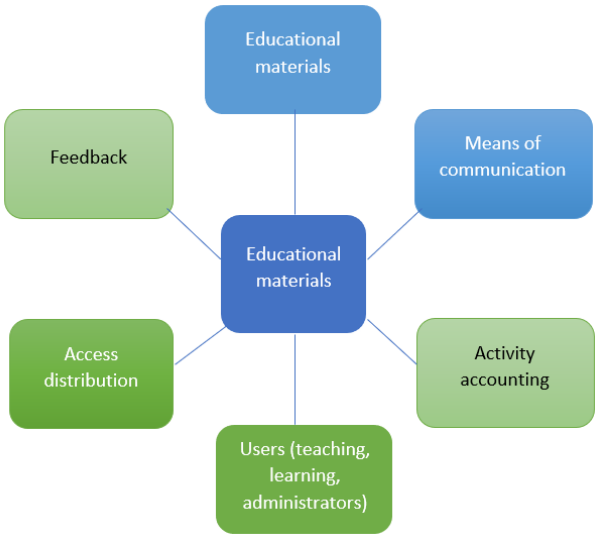

Fig. 1. Structure of the LMS

Among the freely distributed LMS, the most widespread are distance and network learning systems created on the Moodle platform (Modular Object-Oriented Dynamic Learning Environment) related to the LMS (Learning Management System) (Zmeev i dr., 2018; Rymanova et al., 2015).

But with all the advantages of this training technology, there is a question of the effectiveness of these tools (Nikonova et al., 2023). The effectiveness of using remote support tools based on the Moodle platform in teaching students of technical specialties a foreign language reflects the measure of consistency of the results obtained with the tasks and goals of the educational process with a minimal consumption of time and labor of students and teachers.

The evaluation of the efficiency of using the portal of information educational technologies based on the Moodle platform can be a criterion and justification for its use in the learning process. Therefore, in the next section, we will experimentally test the effectiveness of remote support tools.

2.1. Experimental testing of the efficiency of the portal of information educational technology based on the Moodle platform

To assess the effectiveness of using the portal of distance learning technology based on the Moodle information platform in teaching to students of non-linguistic specialties Foreign Language, an experiment was conducted.

We emphasize that the discipline «Basic course of a foreign language» refers to the main part of the cycle of foreign language learning by students of technical specialties and is studied in semesters 1-3.

The total number of hours for three semesters of the Basic Course of Foreign Language subject, according to the curriculum, is usually less than 300 academic hours, which is insufficient for the complete study of the course, so the independent students' work on additional exercises as well as vocabulary and grammar tests using distance learning technology appears to be the most effective way to improve the understanding of the material.

The aim of the study was to determine whether the use of remote information technology contributes to better understanding of the material when teaching students of technical specialties a foreign language.

In order to achieve this goal of the study, the following tasks were set:

1) choose experimental and control subgroups;

2) explain the details of the experiment to the students of the experimental subgroup;

3) conduct a defining pre-experimental cut (pre-test) in the control and experimental subgroups in order to identify the level of knowledge of a foreign language (English);

4) develop additional exercises as well as vocabulary and grammar tests using the learning platform Moodle;

5) task the students of the experimental group to independently mastering the additional educational material, well as grammar and vocabulary tests, posted on the portal of distance educational technologies based on Moodle distance learning systems;

6) conduct a post-experimental cross-section (control test) in the control and experimental subgroups to identify the level of foreign language (English) skills;

7) analyze the results of the control test in the experimental and control subgroups.

The study involved first-year students of the Institute of Industrial Management, Economics and Trade of the St. Petersburg Polytechnic University, studying in the field of training 38.03.01 «Economics and Management at the Enterprise». To implement the research objectives, two study groups of non-linguistic students studying the discipline «Basic course of a foreign language» were selected from the general lecture stream.

Each group consisted of 15 students, with 8 male and 7 female students of 17-19 years old. Thus, the students were divided into control and experimental groups by using the serial (nested) sampling.

During the educational experiment, a stating (pre-experimental) test was conducted in the control and experimental subgroups (Table 3). The Application (Figure 1) shows a fragment of the pre-experimental slice (pre-test).

Table 3. Results of the pre-experimental slice in the control and experimental subgroups

Control group		Experimental group	
Student	Result, %	Student	Result, %
Student #1	42	Student #16	67
Student #2	42	Student #17	52
Student #3	59	Student #18	52
Student #4	70	Student #19	49
Student #5	28	Student #20	33
Student #6	42	Student #21	58
Student #7	42	Student #22	51
Student #8	41	Student #23	52
Student #9	45	Student #24	35
Student #10	58	Student #25	48
Student #11	45	Student #26	57
Student #12	59	Student #27	34
Student #13	68	Student #28	72
Student #14	54	Student #29	41
Student #15	43	Student #30	70
Average value	49.2	Average value	51.4

From Table 3 it follows that the results of the pre-experimental slice in the control and experimental groups are almost the same – they differ by about 2 %.

Then students from the experimental group were given the task to independently master the additional educational material posted on the portal of distance educational technologies “Portal of DOT SPbSPU” based on Moodle distance learning systems.

Teaching materials used to teach first-year university students were selected as material for the development of additional exercises as well as vocabulary and grammar tests, using distance learning technologies based on the Moodle platform.

When selecting vocabulary tests and assignments, the «Work» topic was chosen (Cotton et al., 2008). For the development of grammar tests and assignments, the «Present Perfect Simple and Continuous» topic was chosen.

In the portal of distance learning technologies based on Moodle distance learning systems, we were created an additional block «Extra Module on Work», containing additional exercises, as well as lexical and grammar tests (Application, Figure 2).

The Application presents examples of a lexical test (Figure 3-4) and examples of a grammatical test (Figure 5-6) in the developed additional block «Extra Module on Work».

After the students from the experimental group independently worked out all the additional exercises, as well as lexical and grammatical tests using distance learning technologies, a post-experimental slice (control test) was carried out to determine the degree of assimilation of a foreign language. The fragment of the post-experimental slice (control test) is presented in the Application (Figure 7).

Table 4 shows the results of the post-experimental slice.

Table 4. Results of the post-experimental slice in the control and experimental subgroups

Control group		Experimental group	
Full name	Result, %	Full name	Result, %
Student #1	56	Student #16	72
Student #2	71	Student #17	84
Student #3	54	Student #18	71
Student #4	65	Student #19	81
Student #5	57	Student #20	66
Student #6	36	Student #21	83
Student #7	62	Student #22	54
Student #8	51	Student #23	86
Student #9	33	Student #24	77
Student #10	51	Student #25	68
Student #11	49	Student #26	81
Student #12	59	Student #27	62
Student #13	70	Student #28	81
Student #14	61	Student #29	81
Student #15	64	Student #30	78
Average value	55.93	Average value	75

The final indicators of pre-experimental and post-experimental slices are generalized in the diagram (Figure 2).

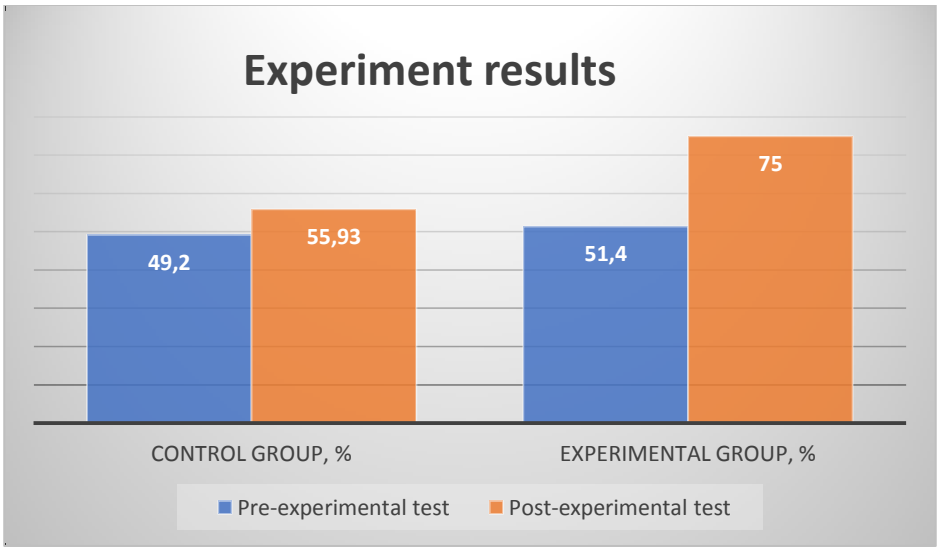

Fig. 2. Results of pre-experimental and post-experimental slice in control and experimental groups

The results presented in the diagram demonstrate that independent work with the "Additional module on work" block created on the Moodle learning platform allowed students from the experimental subgroup to show significantly better results in solving the vocabulary and grammar test during the post-experimental slice, compared to the control group.

Empirical data obtained during the experiment were analyzed using statistical analysis. If the distribution type or the sample distribution function is given to us, then the problem of assessing the differences between two groups of independent observations can be solved using parametric statistical criteria (Rock et al., 2016).

To analyze the results of the post-experimental cross-section in the control and experimental groups, Student's t-test was used. Student's t-test is used to test the hypothesis of equality of the general averages of two independent, unrelated samples (the so-called two-sample t-test).

$$t_{emp} = \frac{x_{av} - y_{av}}{\sigma_{x-y}}, \quad (1)$$

where x_{av}, y_{av} are the arithmetic mean of the control and experimental groups, σ_{x-y} is the standard error of the difference in the arithmetic mean.

$$\sigma_{x-y} = \sqrt{\frac{\sum(x_i - x_{av})^2 + \sum(y_i - y_{av})^2}{n_1 + n_2 - 2} \cdot \left(\frac{1}{n_1} + \frac{1}{n_2}\right)}, \quad (2)$$

where n_1, n_2 are the values of the first and second samples respectively.

If $n_1 = n_2$, then the standard error of the difference in the arithmetic mean is determined by the formula:

$$\sigma_{x-y} = \sqrt{\frac{\sum(x_i - x_{av})^2 + \sum(y_i - y_{av})^2}{(n-1)\cdot}}, \quad (3)$$

where n is the sample size.

Calculation of the number of degrees of freedom is carried out according to the formula:

$$k = n_1 + n_2 - 2 \quad (4)$$

If the samples are numerically equal, $k = 2n - 2$.

Then we need to compare the obtained value of t_{emp} with the theoretical value of t_{crit} - the Student distribution. If $t_{emp} < t_{crit}$, the hypothesis H_0 is accepted, otherwise, the null hypothesis is rejected and the alternative hypothesis is confirmed. If the empirical value of t obtained during the experiment is higher than the tabular value, then there is a reason to accept the alternative hypothesis H_1 that students in the experimental group on average show a higher level of knowledge.

3. Results and discussion

The calculation of the Student's t-test based on the results of the pre-experimental slice in the experimental (sample B.1) and control (sample B.2) groups is presented in Table 5.

Table 5. Results of Student's t-test

No.	Samples		Deviations from mean $(x_i - x_{cp})$		Deviation squares $(x_i - x_{cp})^2$	
	B.1	B.2	B.1	B.2	B.1	B.2
1	72	56	-3	0.07	9	0.0049
2	84	71	9	15.07	81	227.1049
3	71	54	-4	-1.93	16	3.7249
4	81	65	6	9.07	36	82.2649
5	66	57	-9	1.07	81	1.1449
6	83	36	8	-19.93	64	397.2049

7	54	62	-21	6.07	441	36.8449
8	86	51	11	-4.93	121	24.3049
9	77	33	2	-22.93	4	525.7849
10	68	51	-7	-4.93	49	24.3049
11	81	49	6	-6.93	36	48.0249
12	62	59	-13	3.07	169	9.4249
13	81	70	6	14.07	36	197.9649
14	81	61	6	5.07	36	25.7049
15	78	64	3	8.07	9	65.1249
Amounts:	1125	839	0	0.05	1188	1668.9335
Average:	75	55.93				

Result: t_{emp} = 5.2.

The value of t_{emp} obtained in the experiment is compared with the table value of t_{crit}. The table value of t_{crit} is 2.05, assuming the risk of an error of judgment in five cases out of a hundred (significance level = 5 % or 0.05).

If the empirical value of t_{emp} obtained in the experiment exceeds the table value, then there is a reason to accept the alternative hypothesis (H_1) that the students of the experimental group, on average, showed a higher level of knowledge. In the experiment, t_{emp} = 5.2. The table value of t_{crit} is 2.05. Thus, we get $t_{emp} > t_{crit}$, from which follows the conclusion about the advantage of experimental learning.

The obtained empirical value t_{emp} = 5.2 is in the zone of significance ($p < 0.01$). Consequently, the students from the experimental group showed an average higher level of knowledge compared to the control group.

4. Conclusion

Application of information technologies in distance learning of students of technical specialties to a foreign language allows effectively organize students' independent work on additional exercises as well as vocabulary and grammar tests taking into account the insufficiency of classroom hours for the full mastering of Foreign Language.

The final results of the experiment prove that independent work with the «Additional module on work» block created on the Moodle learning platform allowed students from the experimental subgroup to show significantly better results in solving the vocabulary and grammar test during the post-experimental slice, compared to the control group. Thus, the effectiveness of the use of information technology in distance learning of students of technical specialties to a foreign language is confirmed.

Summing up, we note that the use of remote support for students studying Foreign Language greatly facilitates the control of students' learning activities, because it allows teachers to track the progress of each individual student (which is impossible with a frontal check of homework in the classroom) and, accordingly, stimulates students to work more efficiently. This saves the teacher a lot of time, because the check is done automatically. After analyzing the results of different tasks, the teacher can focus on the issues that have caused difficulties, without wasting time on the analysis of successfully completed tasks, which reduces the cost of training time.

The conducted research proves the effectiveness of the use of modern distance technologies in teaching students of technical specialties a foreign language.

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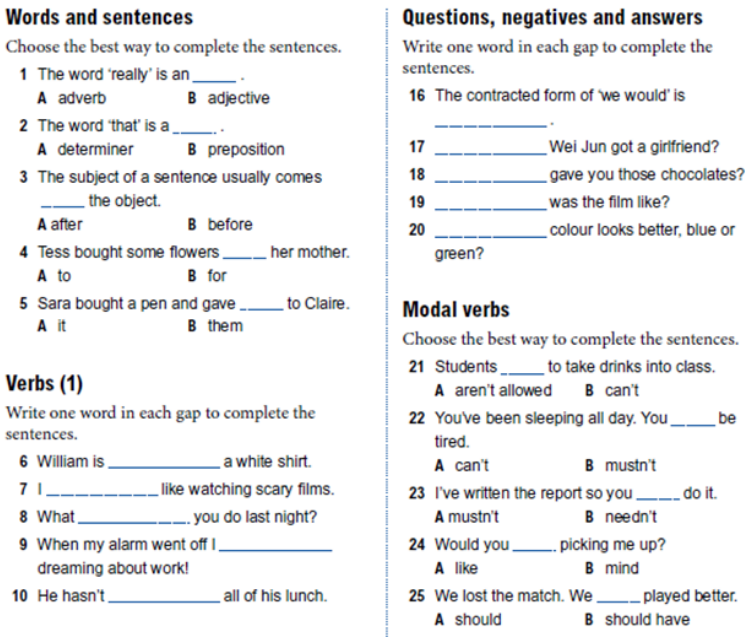
Appendix

Methodological materials for the study



Words and sentences

Choose the best way to complete the sentences.

1 The word 'really' is an ____ .
A adverb B adjective

2 The word 'that' is a ____. .
A determiner B preposition

3 The subject of a sentence usually comes ____ the object.
A after B before

4 Tess bought some flowers ____ her mother.
A to B for

5 Sara bought a pen and gave ____ to Claire.
A it B them

Verbs (1)

Write one word in each gap to complete the sentences.

6 William is _____ a white shirt.

7 I _____ like watching scary films.

8 What _____ you do last night?

9 When my alarm went off I _____ dreaming about work!

10 He hasn't _____ all of his lunch.

Questions, negatives and answers

Write one word in each gap to complete the sentences.

16 The contracted form of 'we would' is _____ .

17 _____ Wei Jun got a girlfriend?

18 _____ gave you those chocolates?

19 _____ was the film like?

20 _____ colour looks better, blue or green?

Modal verbs

Choose the best way to complete the sentences.

21 Students ____ to take drinks into class.
A aren't allowed B can't

22 You've been sleeping all day. You ____ be tired.
A can't B mustn't

23 I've written the report so you ____ do it.
A mustn't B needn't

24 Would you ____ picking me up?
A like B mind

25 We lost the match. We ____ played better.
A should B should have

Fig. 1. Fragment of the pre-experimental slice (pre-test)

Fig. 2. Additional block «Extra Module on Work»

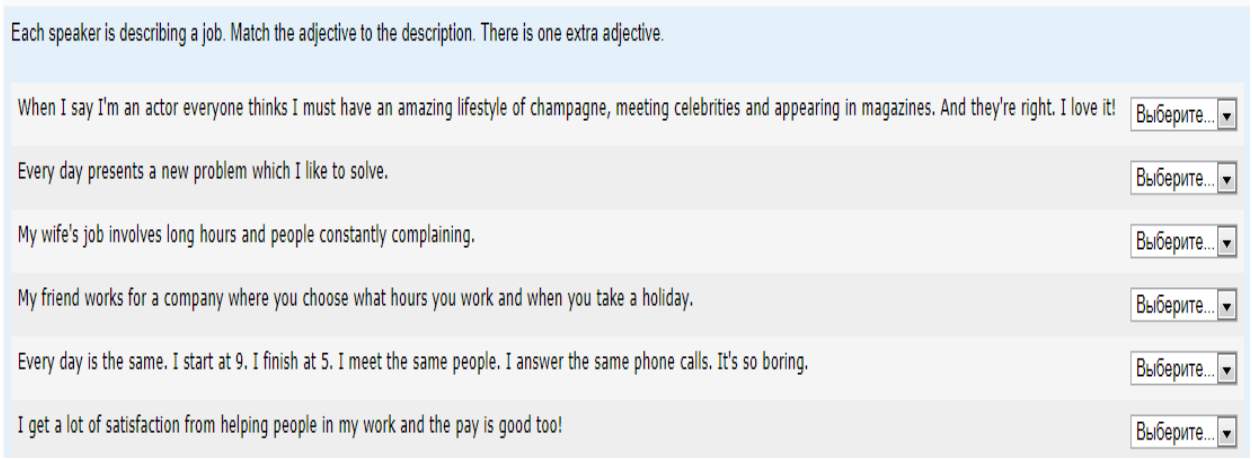


Fig. 3. Example of a vocabulary test in the developed additional block «Extra Module on Work»

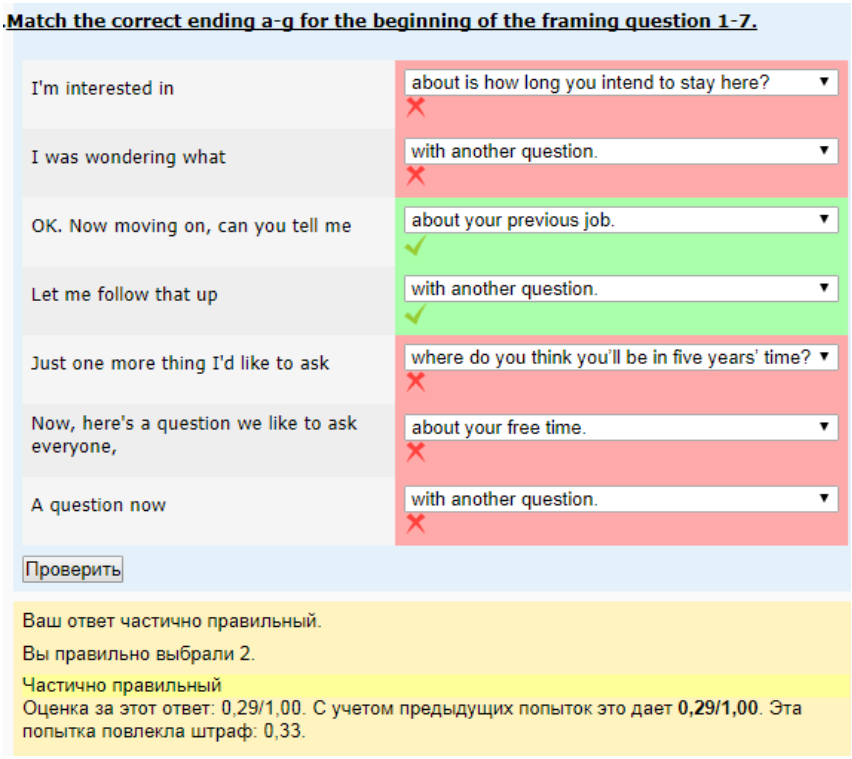


Fig. 4. Example of a vocabulary test in the developed block «Extra Module on Work»

Figures 5-6 show examples of a grammar test in the developed block «Extra Module on Work».

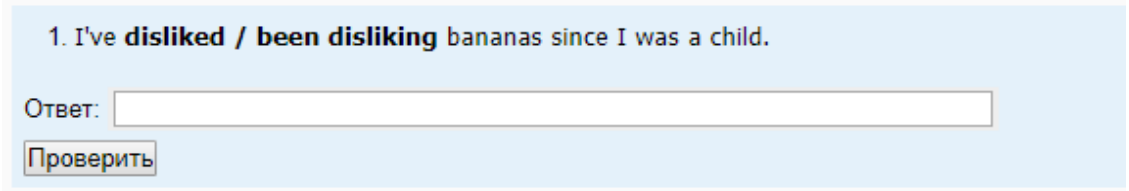


Fig. 5. Example of a grammar test in the developed additional block «Extra Module on Work»

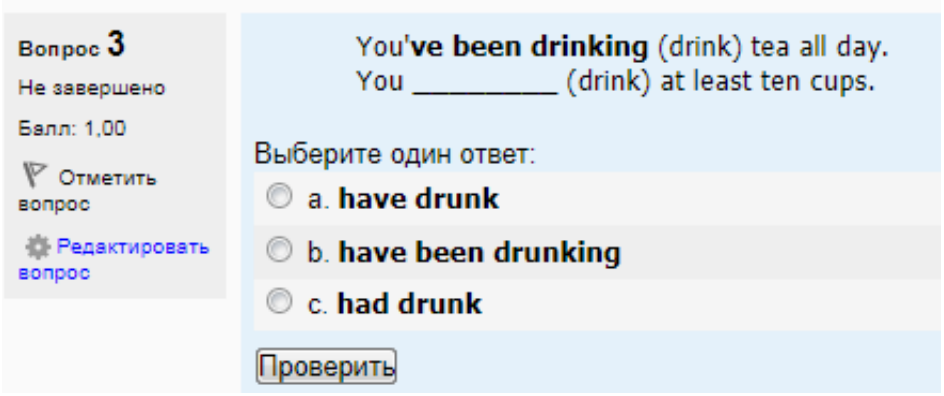


Fig. 6. Example of a grammar test in the developed additional block «Extra Module on Work»

1.1. Each speaker is describing a job. Match the adjective to the description. There is one extra adjective.

glamorous / exciting / rewarding / challenging / flexible / stressful / repetitive

1) I get a lot of satisfaction from helping people in my work and the pay is good too! _____
2) Every day presents a new problem which I like to solve. _____
3) When I say I'm an actor everyone thinks I must have an amazing lifestyle of champagne, meeting celebrities and appearing in magazines. And they're right. I love it! _____
4) My wife's job involves long hours and people constantly complaining. _____
5) Every day is the same. I start at 9. I finish at 5. I meet the same people. I answer the same phone calls. It's so boring. _____
6) My friend works for a company where you choose what hours you work and when you take a holiday. _____

1.2. Complete the sentences with one of the following adjectives + the correct preposition:

afraid / different / interested / proud / responsible / similar / sure

1) I think she's arriving this evening but I'm not _____ that.
2) Your camera is _____ mine but it isn't exactly the same.
3) Don't worry. I'll look after you. There's nothing to be _____.
4) 'Do you want to watch the news on television?' 'No, I'm not _____ the news.'
5) The editor is the person who is _____ what appears in a newspaper.
6) Mrs. Davis is a very keen gardener. She's very _____ her garden and loves showing it to visitors.
7) I was surprised when I met her for the first time. She was_____ what I expected.

Fig. 7. Fragment of the post-experimental cross-section (control test)

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Interpretation of Mathematical Tasks Misunderstanding in the Context of Disciplinary Literacy of University Students

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Abstract

In the article, we focus on the investigation of the disciplinary literacy of technical university students with an emphasis on understanding the mathematical language and symbolism in the tasks assignment. As part of the pedagogical research, we were looking for an answer to the research question "How do students interpret the misunderstanding of the assignment?". In the first phase of the research, the students solved a test that contained four pairs of mathematical tasks: a standard task and its equivalent, which required the mastery of mathematical symbolic language at a higher level. In the second phase of the research, students filled out a questionnaire that contained possible causes of failure in solving tasks in the test. Based on the research findings, we can state that the teachers and students agreed on only one item of the questionnaire, namely that the primary cause of the students' failure was a misunderstanding of the assignment. Teachers and students differed statistically significantly in their responses to the other items of the questionnaire. Based on the students' statements, we conclude that their understanding of the assignment of the task corresponds with the ability to assign the learned calculation procedure to the task, that is, with procedural knowledge. Teachers attributed the causes of student failure in the test to insufficient knowledge of the mathematical language.

Keywords: disciplinary literacy, disciplinary reading, student, language of mathematics.

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1. Introduction

As part of the university study of mathematical disciplines, students are expected also to conduct self-study. For this, it is necessary they have adequate support in the form of quality study material and also support from the teacher (Kolodner et al., 2003). According to Martin et al. (2019) it is necessary to find a symbiosis between various sources of support, especially between support from the teacher and material resources. A common element of student support is explanations of concepts and problem-solving procedures. Explanations form the basis of teaching and learning, but concrete explanations do not always lead to successful learning (Wittwer Renkl, 2008), despite the fact that teachers use explanations on a daily basis. One of the reasons why explanations do not always lead to successful learning may be the lack of connection between the advanced skills of teachers of mathematics subjects and the skills of students in mathematics (Gee, 2012). One of the significant barriers that prevents the creation of the necessary connection (synergy) between teacher and student is the language of mathematics. The language of mathematics, unlike language as a means of communication, does not contain elements of time and emotional elements. However, it has its own grammar, syntax and sentence structure (Moursund, 2005). According to Adams (2003), students should be able to read mathematical sentences, symbols and diagrams in order to be successful in mathematics. Several researches (e.g., Bergqvist et al., 2018; Andanik Fitrianawati, 2018; Ünal et al., 2021) confirmed the correlation between the ability to read mathematical texts with comprehension and success in mathematics. From the mentioned research, it is necessary for mathematics teachers to know the extent to which students can understand the language of mathematics and to adapt the language of explanation accordingly. The ability to read, write and explain clearly in a specific academic discipline, in our case mathematics, is the content of disciplinary literacy (Fang, Chapman, 2020). Disciplinary literacy was defined as "the use of reading, thinking, researching, speaking, and writing necessary to learn and form complex content knowledge appropriate to a specific discipline" (McConachie, Petrosky, 2010: 6).

The goal of teaching mathematics are mathematically literate people, i.e., j. people able to think mathematically and use mathematical knowledge in practical life, which is different from teaching mathematical content (Piatek-Jimenez et al., 2012). According to Hillman (2014), the foundation of mathematical literacy is discourse, which requires students to explain their reasoning and problem-solving procedures. According to Sfard (2007), mathematical discourse is characterized by four textual features: mathematical words, narratives, visual mediators, and routines (mathematical words, stories, visual mediators and routines.) By studying the transformations in these signs, several experts assume the discursive development of students (e.g., Sfard, 2007; Munson, 2019). To develop students in mathematical discourse, it is necessary that students are able to learn from available resources and that there is synergy between these resources (Tabak, 2004; Tropper et al., 2015; Hähkiöniemi et al., 2022). To create this necessary synergy, disciplinary literacy is required from teachers - the creators of teaching texts – in order to be able to communicate the knowledge of the given scientific discipline correctly (Shanahan Shanahan, 2012). At the same time, it is necessary to develop not only content, but also disciplinary literacy of students. The aim of our research was to find out how students interpret the misunderstanding of the assignment.

Reading in mathematics

Mathematics teachers, in an effort to support student learning, constantly produce teaching texts in which they explain the subject matter to their students. The explanations found in the study materials are of different quality (Chi et al., 2001; Lew et al., 2016), which may not be the only factor affecting the suitability of the given study material for students. According to Capraro et al. (2012), teachers assume that students can analyze and synthesize the main ideas of a mathematical text, learn unfamiliar vocabulary through context, draw and justify conclusions with evidence from the text, and monitor understanding of new knowledge. However, several research studies point to the fact that college students have significant reading comprehension problems in mathematics textbooks (Shepherd et al., 2012; Doerr Temple, 2016). The reason for these difficulties may be the language of mathematics used by the teacher when writing teaching texts. According to Azmi (2021), when creating teaching texts, it is necessary to consider the important fact that the teaching of mathematical content is connected with the teaching of mathematical language. According to Doerr and Temple (2016), it is already beneficial for students in secondary

schools if contact with mathematical professional language that is in accordance with the norms of the discipline, part of learning mathematics. In this way, it is possible to build solid foundations of mathematical knowledge in students at a young age and build the prerequisites for using mathematics later in life (Cervetti, 2021; Grysko, Zygouris-Coe, 2020). The need to link the teaching of mathematical content and mathematical language is emphasized by mathematics researchers (e.g. Kulm et al., 2007; Purpura et al., 2017; Lin, 2021), who state that students' understanding of mathematical concepts depends largely on their mastery of the vocabulary used to define and explaining mathematical concepts and procedures and their ability to recognize the meaning of words in a given context. Text structure plays an equally key role in text comprehension (Piccolo et al., 2008).

The method of acquiring mathematical knowledge from the point of view of the cognitive process in mathematics is also related to this. In the process of forming mathematical knowledge, it is mainly a procedural or conceptual acquisition of knowledge (Dubinsky, 1991; Gray, Tall, 1994; Sfard, 1991). Procedural understanding is focused on processes – it requires knowledge of algorithms, techniques and methods by which we arrive at a result. Procedural understanding is preferred by students who prefer memorizing mathematics over actually understanding it (Shirvani, 2016). Hiebert, Lefevre (1986), distinguish two types of procedural knowledge. One is familiarity with the individual symbols of the system and the syntactic conventions that create acceptable configurations of symbols. Another type of procedural knowledge is rules or procedures for solving mathematical problems. Many of the procedures that students master seem to consist of a chain of instructions on how to manipulate symbols. Conceptual understanding expresses the interrelationships between basic elements within a larger structure that enable them to function together. Hiebert, Lefevre (1986) characterize conceptual knowledge as knowledge rich in relations, which we can think of as an interconnected web, a network in which relations are as important as separate information. Shirvani (2016) states that conceptual understanding helps to use acquired knowledge even in non-standard situations.

According to Sfard (1991), any mathematical concept is usually defined both conceptually and procedurally (e.g., when defining rational numbers procedurally, we speak of a rational number as the result of dividing two integers; in the conceptual definition of the concept of a rational number, we mean a pair of integers that is a member of a specially defined set of pairs). Research shows that the best results in mathematics are achieved by students who acquire both conceptual and procedural understanding of mathematical concepts.

Introducing disciplinary literacy practices into the teaching of mathematics allows students to approach the thinking, learning and speaking of scientists (Cervetti, 2021). This key approach requires students to move from reading comprehension of text content to disciplinary reading that promotes mathematical thinking and professional discussion skills (Shanahan, Shanahan, 2012). Since the 1990s, the field of mathematics education has demanded the creation of written texts that use language in a discipline-specific way (e.g., Chapman, 1997; Burton, Morgan, 2000; Sfard, 2007; Draper, Siebert, 2004). At the same time, teachers are encouraged to focus not only on content literacy, but also on disciplinary literacy when creating teaching texts (Moje, 2008). At the secondary school level, these requirements were met with resistance from teachers (Alvermann, Moore, 1991; O'Brien et al., 1995), who perceived the teaching of reading strategies as a matter of extracurricular pedagogy (Dillon et al., 2011; Draper et al., 2010). The implementation of disciplinary literacy promises to resolve this "dualism" of disciplinary and content literacy by replacing the teaching of general reading strategies with the teaching of discipline-specific strategies (Draper et al., 2005).

According to Shanahan Shanahan (2012), content literacy focuses on study skills that help students learn from subject-specific texts. Disciplinary literacy, on the other hand, emphasizes the abilities of those who create, communicate, and use knowledge within disciplines. The goal of disciplinary literacy is to identify differences in reading and writing between disciplines and to find ways to implement this knowledge into teaching disciplines so that students can read and communicate like experts in that discipline (Shanahan, Shanahan, 2012). The need to simultaneously develop both content and disciplinary literacy is justified because school teaching of subjects can be considered disciplinary discussions recontextualized for educational purposes (Fang, Coatoam, 2013). An integral part of disciplinary literacy, and thus students' academic success, is the proficiency in academic language (Johnson et al., 2011).

Each discipline has a unique language and according to Johnson et al. (2011), each language typically consists of a specialized vocabulary, sentence structure, and symbol system, creating specific features of disciplinary texts. Hyland (2020) considers each scientific discipline as a distinctive discourse community with its own way of structuring communication and knowledge. We conceptualize mathematical language as a mode of discourse that is focused on learning mathematics and contains an expressive (speaking and writing) and a receptive (reading and listening) component (Barton et al., 2002). The specifics of mathematical language have been described by several studies (e.g., Fang, 2012; Fang, Schleppegrell, 2010; O'Halloran, 2005; Schleppegrell, 2007), which point to the fact that mathematical vocabulary is highly specialized and cognitively demanding. Unknown words that carry a large part of the content of a mathematical text are little known from everyday life and have multiple meanings. Some words have a different meaning in mathematics than in everyday life (Capraro, Joffrion, 2006). Therefore, reading mathematical texts requires increased demands on the reader's critical reading skills (Gardner, 2007), which the reader needs to be able to understand the exact expression of the words used and the way to solve the problem. In order to implement disciplinary literacy in teaching, it is necessary to simultaneously identify the characteristic elements of professional texts (Neugebauer, Gilmour, 2020).

Mathematical professional texts have a multimodal character because they communicate information through linguistic, symbolic and visual representations. In addition, mathematical texts are also characterized by conceptual density, as they often contain more important concepts per line, sentence or paragraph than any other type of text, which is another factor causing problems for students when reading mathematical texts (Barton et al., 2002; Wiesner et al., 2020). On the basis of the mentioned research, it can be concluded that students entering the first year of the B.Sc. have problems reading professional mathematical texts. These problems are caused by the specifics of mathematical disciplinary language and the structure of mathematical texts. Both of these factors are the subject of disciplinary literacy, and therefore it is justified to look for ways to help students improve their reading of mathematical texts. According to Barton et al. (2002) helping students with mathematical texts does not mean teaching them to read. Rather, it is necessary to enrich them with special reading skills that they do not use in other scientific fields. For example, in addition to understanding text that is organized differently than in core subjects, students must be able to decode and correctly interpret mathematical symbols, tables, and graphs. Reading, like learning, is a constructive process in which students draw on prior knowledge and experience (Vacca, Vacca, 1999).

The more knowledge and skills the teacher puts into the text, the better the students will learn new knowledge from the read text. One of the ways in which teachers try to make it easier for students to read mathematical texts is the creation of teaching texts that explain mathematical concepts or calculation procedures in a "non-mathematical" way. They use real contexts, express mathematical principles in an informal way and use less technical language (Davis, 2012; Stylianides, 2009). Such a form of teaching mathematics texts is significantly different from disciplinary texts (Thompson et al., 2012) and contributes to students' difficulties in reading mathematics texts in future studies (Brantlinger, 2011). Instead of moving away from disciplinary mathematics texts, it is more appropriate to develop students' abilities to read disciplinary texts (Borasi, Siegel, 2000; Fang, Coatoam, 2013). Fang and Chapman (2020) emphasize that disciplined reading is one way that can help students improve their own mathematical competence. For disciplinary reading strategies to be effective in learning mathematics, they must be embedded in meaningful disciplinary experiences where students explore issues relevant to the discipline (Fang, Chapman, 2020). Understanding the way texts are read by experts in a given scientific field will enable educators to design appropriate strategies to support students' necessary ability to read professional texts. According to Fisher (2018), mathematicians use different strategies when reading scholarly texts than do historians or chemists. Some other scientific studies have also revealed that the ways of reading scientific texts by disciplinary experts are specific to the given discipline (Burton, Morgan, 2000; Shanahan Shanahan, 2008; Johnson, Watson, 2011; Mejia-Ramos, Weber, 2014; Melhuish et al., 2022).

For example, Weber (2008) states that when reading a mathematical proof, mathematicians first use a shrinking strategy (i.e., examine larger parts of the logical structure) before reading each line of the text in more detail (a zooming strategy). In contrast to Weber (2008), Inglis and Alcock (2012) report that research-active mathematicians used a zoom-in strategy and did not use a

shrink-in strategy. When reading the text of a mathematical proof, mathematicians focused their attention first on the logical details of the argument and did not examine the overall logical structure of the proof text. Another study found that mathematicians use the structure of a text to support their comprehension and carefully compare new information with their prior knowledge as they read (Shanahan et al., 2011). In a study conducted by T. Shanahan Shanahan (2008), mathematicians reported that they use close reading and rereading as their dominant strategies when reading academic texts because every word counts when learning from a text. Close reading and re-reading of expressions that have precise meaning is part of mathematical literacy (Gritter, 2010; Shanahan, Shanahan, 2008). In their study, Hodds, Alcock, and Inglis (2014) found that rereading, monitoring, paraphrasing, and questioning are effective strategies that students can use when reading disciplinary mathematics texts. However, these strategies are also used by experts in other disciplines, such as literature and history (Chapman, 2015; Rainey, 2017)

The problem is that general reading practices are rarely taught in alignment with disciplinary goals (Dillon et al., 2011), leading mathematics teachers to view them as irrelevant to mathematics instruction (Shanahan, Shanahan, 2008). Likewise, Hillman (2014) in her review of the literature on disciplinary literacy in mathematics found that little attention has been paid to how teachers implement the demands of disciplinary literacy into their teaching. Disciplinary literacy provides the language through which mathematical literacy grows, is used, and is shared. When we equip every student to use a full range of communication strategies and tools – including those particular to the discipline of mathematics – we also enable them to identify themselves as knowers and doers of mathematics. With these strong mathematical identities, they can comfortably and ably apply mathematical thinking and tools in a wide variety of abstract and real-world situations, which may be the most practical outcome of being literate in mathematics.

According to Fountas Pinnell (2018), students with a developed ability to read disciplinary texts are able to think beyond the scope of the text they are reading because they are not focused only on the content of the text. This fact corresponds with the results of research by Lent (2017), who found that when mathematicians read, they look for patterns and relationships, try to decipher symbols and abstract ideas, ask questions and apply mathematical reasoning, which includes the use of previous knowledge. These are the strategies that gradually transform students into experts in the field of mathematics, which is one of the reasons for the implementation of disciplinary literacy in the teaching of mathematics (Shanahan, Shanahan, 2012). Mathematical disciplinary reading presupposes linguistic understanding and knowledge of the "language of mathematics" (Esty, 2011). Adams (2003) emphasizes that students should be able to read mathematical sentences, symbols and diagrams in order to be successful in mathematics. However, Wollman (1983) found in his research that university students are not able to adequately express their thoughts using standard mathematical symbols. According to Muth (1991), students' problems with problem solving do not lie in a lack of calculation skills, but in a lack of understanding of the assignment, which is caused by a lack of knowledge of the meaning of mathematical symbols used in mathematical texts (Hiebert, 1988; Adams, Lowery, 2007).

The analysis of scientific literature shows the importance of linking mathematical content with mathematical professional language, the specifics of which cause difficulties for students in learning it. Therefore, it is necessary to pay attention to disciplinary reading when teaching mathematics. The development of disciplinary reading must also be taken into account when creating teaching texts for students. Students capable of disciplinary reading can effectively use the acquired knowledge when solving various tasks. The lack of disciplinary reading ability manifests itself in a misunderstanding of the assignment of the solved task, so the student cannot use the acquired computing skills or uses them to a limited extent.

Research design

Based on the knowledge presented in the previous sections, we carried out pedagogical research in the academic year 2022/2023. Before the start of the research, we approached 183 randomly selected first-year bachelor's degree students at a technical college, who were familiar with the content of the research. Seventy-four 74 students between the ages of 19 and 21 voluntarily decided to participate in the research. All participants were assured of the anonymity of the research and agreed to participate. The research was conducted in two phases. As part of our research, we set the research question:

RQ: How do students interpret the misunderstanding of the assignment?

We used feedback from students to find the answer. According to several experts, the student plays a leading role in the creation of feedback (Carless, Winstone, 2020, Tai et al., 2018, Winstone et al., 2017). It is known that a suitable form of feedback for university students is self-evaluation, which includes reflection on one's own products (Harris, Brown, 2013). Since the accuracy of self-assessment can be determined by comparing a student's self-assessment with the judgments of qualified evaluators, such as teachers or classmates, or with test performance (Panadero, Lipnevich, 2022), we also included six teachers in our research. The research was conducted in two phases. In the first phase, students completed a math test that included four standard tasks and four tasks that required students to master mathematical symbolic language at a higher level. Tasks that required proficiency in higher-level mathematical symbolism were intentionally set to be equivalent to tasks that were set as standard math tasks. So, the test contained four pairs of tasks. If the student has solved the standard task, he should also solve its equivalent, provided he can correctly read the mathematical symbolic language.

Let us give an example. As a standard task, we classified e.g., task:

Construct the graph of the function $y = 3x - 1$.

Its equivalent, a task with higher demands for controlling (mastering) mathematical symbolic language, was the given task:

Represent the set: $A = \{(x, y): x = y + 1; x, y \in R\}$.

After passing the test, we asked six teachers to evaluate together the developed tests of the students. The second phase of the research took place approximately one hour after the end of the test. First, the students were informed about the results they achieved in the test by being told which task they solved correctly and which one incorrectly. Subsequently, we asked the students to fill out a questionnaire. The questionnaire contained seven items that contained possible reasons for the student's failure to solve the tasks in the test. The students commented on the individual items of the questionnaire using a Likert scale from 1 to 4 (1 – weak belief; 2 – mild belief; 3 – strong belief; 4 – strong belief) and thereby expressed their opinion (feedback) about the cause of their failure when solving tasks in the test.

Subsequently, we asked the teachers who evaluated the students' test results to also fill out a (modified) questionnaire and thus express their opinion on the causes of the students' test failures. We analyzed the results obtained by the experiment using statistical methods of qualitative features.

2. Data analysis

For the analysis of the results obtained by the questionnaire method, we used the χ^2- test of independence for the $k \times m$ type contingency table. We tested the null hypothesis H_0 characters A, B are independent against the alternative hypothesis H_1: characters A, B are dependent. While character A represents the teachers' answers to the questions listed in the questionnaire and character B represents the students' answers to the questions listed in the same questionnaire. As a test criterion, we used the χ^2 statistic, which is given by the relation

$$\chi^2 = \sum_{i=1}^{k} \sum_{j=1}^{m} \frac{(f_{ij} - o_{ij})^2}{o_{ij}},$$

where f_{ij} are empirical abundances and o_{ij} are expected abundances. The test statistic χ^2 has the validity of the tested hypothesis H_0 χ^2 – distribution with the number of degrees of freedom $r = (k - 1)(m - 1)$.

We reject the tested hypothesis H_0 at the significance level α if the value of the test criterion χ^2 exceeds the critical value $\chi^2_\alpha(r)$. The critical value $\chi^2_\alpha(r)$. can be found in the table of critical values of the χ^2- distribution. As part of our research, we used the χ^2-test of independence for the $k \times m$ contingency table to verify whether there is a significant difference in the answers of students and teachers to each question (or the cause of failure) in the questionnaire. We implemented the test in the STATISTICA program. After entering the data, we received in the output report of the computer a contingency table, the value of the test criterion of the χ^2-test and the p-value, which is the probability of the error we make when we reject the tested hypothesis. We can also evaluate the test based on the calculated p values. If the calculated value p is sufficiently small ($p < 0.05$ or $p < 0.01$), we reject the tested hypothesis H_0 about the independence of the observed features A, B (at the significance level of 0.05 or 0.01). Otherwise, we cannot reject the hypothesis H_0, i.e., the observed differences are not statistically significant.

We assessed the degree of statistical dependence between qualitative features A, B using the *contingency coefficient*, which is defined by the following formula.

$$C = \sqrt{\frac{\chi^2}{n+\chi^2}}, \qquad \text{where } \chi^2 = \sum_{i=1}^{k}\sum_{j=1}^{m} \frac{\left(f_{ij} - \frac{f_i^A f_j^B}{n}\right)^2}{\frac{f_i^A f_j^B}{n}}.$$

The contingency coefficient C takes values from the interval $\langle 0,1\rangle$. If $C = 0$, characters A, B are independent. Values close to zero indicate weak dependence and vice versa, values close to one indicate strong dependence. The interpretation of other values of the contingency coefficient is the same as the interpretation of the values of the correlation coefficient. In the case of a statistically significant difference between the answers of students and teachers, we also calculated the contingency coefficient.

In our case, when testing the statistical relationship between the answers of students and teachers, we used the χ^2-test of independence for the $k \times m$ contingency table to verify whether the students' answers to each question are related to the teachers' answers to the given question.

Results of the χ^2-test and the contingency coefficient are shown in Table 1.

Table 1. Results of the χ^2-test and values of the contingency coefficient

	χ^2	p	C
Item 1	4.368	0.224	-
Item 2	42.397	0.000*	0.588
Item 3	16.717	0.000*	0.460
Item 4	10.929	0.016*	0.453
Item 5	18.498	0.000*	0.539
Item 6	40.083	0.000*	0.628
Item 7	78.000	0.000*	0.707

* Statistically significant values

From Table 1, we can see that the p-value is in all cases, except for question 1, smaller than the chosen level of significance $\alpha = 0.05$, i.e., we reject the hypothesis H_0 at the level of significance $\alpha = 0.05$ and accept the alternative hypothesis H_1. This means that belonging to a group (student or teacher) has a statistically significant effect on the selection from the offered scale for each of the items 2 to 7.

The only reason for failure for which no statistically significant difference was found between the statements of students and teachers was I did not sufficiently understand the assignment (item 1). The statistical test proved ($\chi^2 = 4.368$, $p = 0.224$), that the statement on item 1 does not depend significantly (or statistically significantly) on whether the student or the teacher comments on the given item. The situation is illustrated in Figure 1.

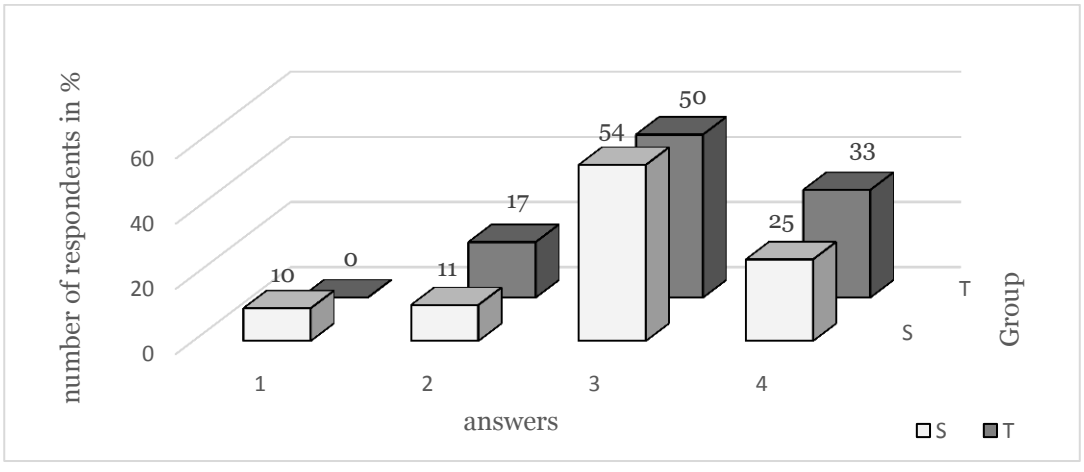

Fig. 1. Distribution of the frequency of student and teacher statements regarding item 1

From Figure 1, we can see that the students and the teachers were strongly and even very strongly convinced that the reason for the students' failure in solving the tasks was a lack of understanding of the assignment.

In the comments on item 2 (I chose the wrong solution procedure), item 3 (I did not remember the entire solution procedure) and item 4 (I did not encounter this type of task), students expressed a strong to very strong belief that their failure in the test was caused by stated reasons. On the other hand, the teachers expressed the opinion that they are weak to moderately convinced that the mentioned reasons were the reason for the students' failure in the test. The most significant difference between the opinions of teachers and students in these three items was for item 2. Figure 2 illustrates this difference of opinion.

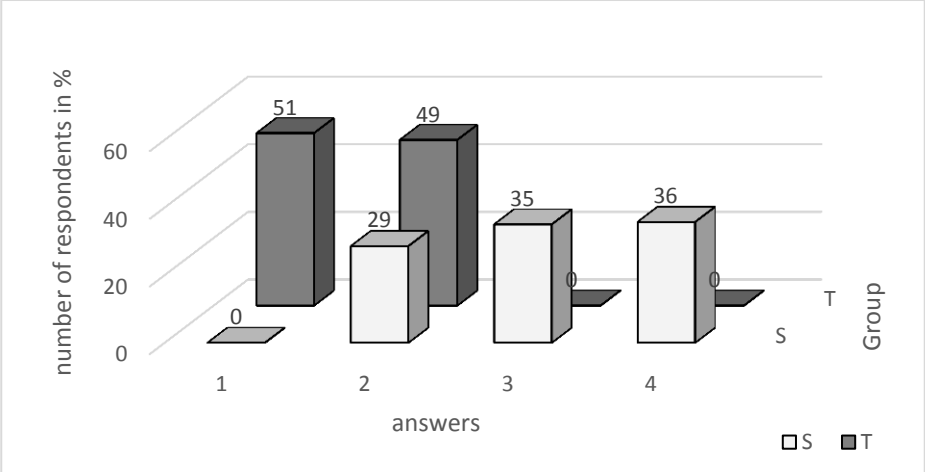

Fig. 2. Distribution of the frequency of student and teacher statements regarding item 2

In Figure 2, we can see that on the item whether the cause of students' failure in solving mathematical problems is the fact "I chose the wrong procedure", all teachers have a weak or only moderate belief, but more than 70 % of students marked "choosing the wrong procedure" as "strong conviction", or is students are mostly strongly convinced that they have chosen the wrong course of action. Based on the calculated value of the contingency coefficient ($C = 0.588$), we can conclude that there is a significant degree of connection between the group (student and teacher) and the choice of response to item from the scale. This means that the choice of expression for item from the scale are statistically significantly dependent on whether the teacher or student commented on the given item.

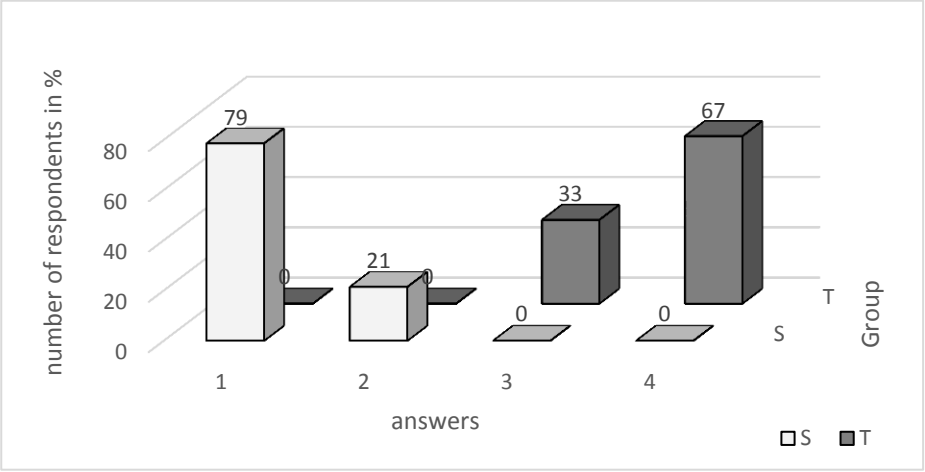

Fig. 3. Distribution of the frequency of statements of students and teachers regarding item 7

In the responses to item 5 (I did not consider the meaning of mathematical symbols), item 6 (I interpreted the mathematical symbols incorrectly) and item 7 (I did not realize the additional

meaning of some mathematical symbols in the assignment) we noted the opposite trend in the responses to the previous three items. Students expressed a weak to moderate belief that the listed factors caused them to fail the test. On the other hand, the teachers expressed the opinion that they strongly or very strongly believe that the mentioned factors were the cause of the students' failure in the test. The most significant difference between the opinions of teachers and students in these three items was for item 7 ($C = 0.707$). Figure 3 illustrates this difference of opinion.

From Figure 3, we can see that 67 % of the teachers expressed a strong belief that not realizing the multiple meanings of some mathematical symbols in the assignment was the cause of the students' failure in the test. On the other hand, up to 79 % of students only weakly agreed that the mentioned fact would be the cause of their failure in the test.

3. Discussion

Mathematical disciplinary reading presupposes knowledge of mathematical language. As part of the first phase of our research, we found that students had a significantly lower success rate in tasks that required a higher level of understanding of mathematical symbolic language. In the questionnaire, the students themselves identified a lack of understanding of the assignment (item 1) as the reason for their failure to solve the assigned tasks in the test. Other reasons for their failure in solving tasks were considered to be an incorrectly chosen solution procedure (item 2) and failure to remember the entire procedure (item 3). These statements of theirs indicate their focus on learning calculation procedures as instructions for solving a certain set of tasks. On the other hand, students did not agree or only weakly agreed that the cause of their failure in the tasks was insufficient proficiency in mathematical symbolism (items 5-7). Based on the statements of the students, which we obtained through the implementation of the experiment, we conclude that their understanding of the assignment of the task corresponds to the ability to assign the learned calculation procedure to the task.

And they associate their potential success or failure in solving tasks with the ability to remember how to calculate a given type of task. These findings showed that the acquisition of calculation procedures is still a priority for students in learning mathematics (Rittle-Johnson et al., 2012), mainly in the form of calculation templates (Lithner, 2017). It is often enough for students to know the rule (instructions) how to find solutions to the assigned task (Legesse et al., 2020) and after reading the assignment, they try to assign some learned procedure to it. According to some research, this approach of students to learning mathematics is also supported by the way mathematics is taught, where the transfer of ready-made calculation procedures prevails (e.g., Leung, 2006; Boesen et al., 2014).

Based on the results of the experiment, we can state that the teachers and students agreed that the primary cause of student failure in tasks requiring higher reading of mathematical symbols was a misunderstanding of the assignment (item 1). Teachers and students differed statistically significantly in their responses to the other items of the questionnaire. The teachers identified as the cause of the students' failure the failure to think about the mathematical symbols in the assignment (item 4). During the interview, the teachers said that they came to this opinion primarily on the basis of the test task: simplify: 2:6·3:4·1:9. It turned out that in this example, only 31 % of students changed the symbol ":" to a fraction line, that is, they rewrote the ratio of two numbers to a fraction. Other causes of failure according to teachers were incorrect interpretation of mathematical symbols (item 5) and failure to consider multiple meanings of a mathematical symbol (item 7). Based on these answers, it can be concluded that the teachers associate the misunderstanding of the assignment with the problems of the students to correctly read and interpret the mathematical symbolic language. Our findings reveal students' beliefs that their failure in mathematics is due to a lack of ability to "count". In contrast, the teachers in our research and experts such as Duru, Koklu, 2011 see the cause in the lack of ability to read a mathematical text with understanding (Duru, Koklu, 2011).

Based on this finding, we would like to suggest that more space be devoted to the development of conceptual understanding of mathematical symbolic language in the teaching of mathematics (Capraro, Joffrion, 2006). The ability to read a mathematical text leads to the discovery of relationships between the data in the assignment of the task, which is a prerequisite for finding one's own solution to the task and allows the student to connect the calculation procedure with the task, or to adapt the calculation procedure to a new task (Rittle-Johnson, Schneider, 2015). Another space where it is possible to convey to students the need to learn to read

mathematical texts is feedback (Panadero et al., 2019), which forms an integral part of communication between teacher and student (Small, Lin, 2018). According to several studies, teachers tend to focus mainly on procedural skills in feedback (Casey et al., 2018; Runnalls, Hong, 2019), but properly targeted feedback focusing on the development of conceptual knowledge pupils has an enormous influence on the progress of students in mathematics (Stovner, 2021).

We consider another important finding of our research to be the finding that is connected with the students' comments on item 4 – I have not encountered this type of task. Up to 65 % of students identified this phenomenon as the cause of their failure in the test. As we have already mentioned, however, the tasks in the test were deliberately designed so that for each standard assigned task, an equivalent task was assigned, but its assignment was predominantly in mathematical symbolic language. While the students' success in the first one was 100 %, only 28 % of them got the second one right, which confirms the fact that the students had a problem reading the symbolic assignment of the task with understanding. Unlike students, teachers did not consider the fact that students did not encounter a given type of task as the cause of student failure. It is in these different expressions of teachers and students that the importance of teaching mathematical symbolic language can be revealed. The teachers' reactions to item 4 expressed their belief that the students' failure in the test was largely caused by their insufficient knowledge of the mathematical language. Therefore, we think that it would be appropriate if the teachers draw attention to this important fact as part of the students' feedback. Appropriately targeted feedback can make it clear to students that their reliance on learned procedures (Boesen et al., 2014) is not a sufficient guarantee of success in mathematics. Inadequate proficiency in the mathematical language can cause students to be unable to solve a problem that is assigned "non-standardly", although it belongs to a set of problems whose calculation procedure is known to the students.

4. Conclusion

Following on from our research question: “How do students interpret the misunderstanding of the assignment?” we can state that their view of their own failure is subjective and based on their mathematical knowledge. Compared to the teachers' view of students' failure to solve tasks with non-standard assignments with an emphasis on the use of mathematical symbolism, we can say that only in one item of the questionnaire did the views of students and teachers differ significantly, namely in insufficient understanding of the assignment of the task. While the students largely attributed their failure to this cause alone, the teachers saw more behind it. With their professional and pedagogical experience, they were able to analyze the causes of student failure more critically and deeply. Since students did not understand or know the meaning of mathematical symbols well enough, they were not able to critically evaluate and attribute their failure to this factor as well, which is logical. At the same time, our findings indicate that students prefer formal knowledge, focusing on learning rather than understanding mathematics. Therefore, they prefer tasks whose solution algorithm is known to them or at least similar to other tasks they know, and even a slight change in the learned procedures can lead to failure. Formalism in the teaching of mathematics is a long-term phenomenon that significantly slows down or stops the development of important intellectual abilities, such as: analyzing a problem situation, arguing, hierarchizing knowledge, sorting knowledge. In order to reveal formal knowledge, the interaction of the teacher and the student through feedback on the subject matter is necessary.

Here we have to agree with studies (Casey et al., 2018; Runnalls, Hong, 2019) that in the framework of feedback, teachers often slip into asking questions focused on procedural knowledge and do not try to reveal the causes of deficiencies in students' conceptual understanding. Often times, the reason is a lack of time in regular teaching, but also the inexperience of the teacher, which is related to the disciplinary literacy of teachers and students. In school education, we often focus on the student's performance towards various national and international tests, therefore the teacher is looking for a way to teach students to solve the expected test tasks as quickly and efficiently as possible, thus supporting their focus on processes and not on concepts in mathematical knowledge. As part of our research, we must point out one more factor that could have influenced its results. The research sample consisted of university students with a technical focus, not students of mathematics as a field or teaching. Within the study of technical fields at high schools and universities, mathematics is primarily a tool for the application of the mathematical apparatus in solving various complex tasks and problems in professional subjects according to the focus of the field of study. However, it is precisely in these subjects of a technical

focus that knowledge of various principles, signs and symbols is required, which also includes mathematical terminology and symbolism, which can lead students to failure in professional, not only mathematical, subjects. So, we come to the important connection of mathematical, professional and disciplinary literacy of students and teachers. Inadequate mathematical and disciplinary literacy can be the cause of failure of students in their university studies of a chosen "non-mathematical" field of study, who fail in the first year precisely for the reasons mentioned, which leads to the disappointment of students who attribute it to mathematics. This opens up space for further research in the field of disciplinary literacy of students of various fields of study, be it technical, natural science or mathematics.

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Teaching Physics: Identification of the Dynamics of the Development of Criteria Indicators of Functional Competence

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Abstract

Today, the teacher faces many practical problems and problems related to improving the quality of education. Solving these tasks requires the formation of functional competence, which is an important indicator of the professional growth of a future teacher. However, it emphasizes the fact that the problem of forming the functional competence of a future teacher in certain subjects has not yet been completely solved. The purpose of the research work is to identify the main factors and pedagogical situations in the formation of functional competence of students in the process of teaching physics lessons, to prove their effectiveness based on the dynamics of growth of indicators of functional competence. The study used methods such as direct and indirect educational observations, tests, surveys, qualitative and quantitative analysis, as well as mathematical and statistical data processing. The research made it possible to determine the component part of the student's functional competencies in physics, to determine the pedagogical conditions and external and internal factors necessary to achieve maximum success of the student's functional literacy in the field of studying the natural science cycle of the University. In addition, the structural components and criteria indicators of functional competencies are determined, the dynamics of the growth of indicators through pedagogical experiment is shown. The results of the study will serve as a great scientific document for subsequent research in the field of functional competence, and will also have a huge impact on the development of science and technology, if viewed from the side of professional activity.

Keywords: functional competence, functional literacy, teaching physics, future physics teachers, criteria indicators.

1. Introduction

The era of globalization requires the improvement of the methodology for the formation of competitive specialists in the education system aimed at the development of all human activities,

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in particular, the sphere of human capital. Professional competence approach is one of the priority systems for the implementation of these needs (Hamaidi et al., 2021).

Education, in general, has a serious impact on the socio-economic, socio-cultural development of the state, its position in the world, its integrity and security. It is believed that the deterioration of the work of schools, pedagogical institutions, and the system of professional development of teaching staff, which is a direct generating factor of spiritual and cultural reproduction of society, quickly leads to a consistent breakdown of the entire continuous system of education.

Therefore, the education system, and above all, the secondary education system, needs teachers who can effectively solve problems to ensure the quality of education in a rapidly changing modern world (Ramankulov et al., 2020).

The goal of modern General secondary education in the conditions of transition to the model of result-oriented education is to ensure the further development of students' abilities to cognition, creative use of the acquired knowledge in any educational and life situation, readiness for self-development and self-management throughout life, i.e. the formation of functional competence.

The results of the theoretical analysis of pedagogical research on the functional competence of students show that the issues of pedagogical research in the subjects of natural sciences are studied individually (Nurgiyantoro et al., 2020). In addition, the results showed that the best practice of teaching based on the formation of functional competencies is not generalized, there is no unified concept and technology for creating and developing an educational environment for the formation of functional competencies of students in the field of natural sciences, especially physics.

Currently, as shown in the works of N. Rybakina, O. Bakhlova, I. Bakhlov, I. Napalkova, A. Soldatova, A. Hakim the competence approach serves as the basis for updating the content of both general and professional education (Rybakina, 2018; Hakim, 2015). The concept of "competence" comes from the Latin competens, competentis, which means proper, capable. In the dictionary of modern Kazakh literary language, competence is defined as awareness in any field of knowledge – competent-knowledgeable, knowledgeable, knowledgeable (Instefjord, Munthe, 2017).

Despite the limited influence of the documents defining the use of relations between universities in accordance with common standards (Aleksić et al., 2022), there is an uneven degree of development of an important field of teaching natural sciences. Although the concepts of "competence" and "official activity" are currently formed, the unified system of its formation and the method of their formation have not been sufficiently studied. Despite a number of articles aimed at assessing the competence index of university students (Škrinjarić, 2022; Sarapaivanich et al., 2019; DeGrande et al., 2018) it is clear that our research problems are far from being solved.

Subjects related to the topics of "Physics" and the methodology of teaching physics at school, by themselves allow you to study the subject and teaching methods. Disciplines based on functional competencies are often poorly supported or not included in educational programs at all. Therefore, when laboratory classes and practical classes in physics are held, which are the professional skill of the teacher, we pay attention to the support and implementation of such work in the school, which attaches professional importance to teaching (Ramankulov et al., 2019; Lizunkov et al., 2020, Berdi et al., 2015).

Taking into account the place occupied by laboratory work and practical work on the subject of physics in terms of the formation of functional competence and literacy, we analyzed the scientific and methodological literature on the subject of physics.

Functional literacy training first appeared in the middle of the twentieth century in accordance with legislative requirements. Today, all over the world, the education system is devoted to key issues related to the elements of functional literacy, that is, affecting social, cultural, political and economic aspects, including the participation of people in lifelong learning. People can quickly interact with the external environment, develop as quickly as possible and work in a changing environment. In this regard, we agree with the good formulation of A.A. Leontiev: "many people are seen as executive directors who can use all the knowledge, skills and mental abilities of a new family to eliminate many homework assignments in other areas of human activity, communication and social interaction".

In the education system, the literature review on the competence approach made it possible to form the content of the basic concepts of "competence", knowledge about the basic definitions of the concept of "competence" (Chen et al., 2017). One of the definitions that formed the basis of our study is competence – the willingness or ability of students to apply the knowledge, skills and

methods acquired in professional activities to solve practical and theoretical problems (Arballo et al., 2019; Vázquez et al., 2019).

Thus, a functionally competent teacher is one who has special thinking and functional abilities, is ready to support students in their own cognitive activity and can direct their activities to introspection, can develop classes that support other areas of learning, teaches special strategies for active learning and can provide constructive feedback.

The selection of levels of formation of the functional competence of a teacher by different authors (Koliasa, 2021; Dimitrova, 2021, Shektibayev et al., 2019) is determined by the content of professional activity and the components of functional competence.

Functional competence implies compliance with the necessary pedagogical conditions and allows students to engage in productive, creative activities (Berestova et al., 2020; Yuan et al., 2017; Lin, Chuang, 2018). In order to achieve high performance of functional literacy of students, special pedagogical conditions must be created.

In articles on pedagogy and teaching methods, the concept of "pedagogical conditions" is often found (Gafiyatova et al., 2019; Bryakova et al., 2022, Dosymov et al., 2023). However, the generally accepted definition of this concept is not accepted by pedagogical science.

Researchers in the field of physics education (Furyaeva et al., 2017; Usembayeva et al., 2015) consider pedagogical conditions that increase the effectiveness of the future physics teacher. These studies state that pedagogical conditions "are objective and subjective prerequisites and requirements, the implementation of which will allow the teacher to achieve his goals in the educational process with the most optimal use of forces and resources."

Based on the conclusions of scientists, we conclude that, despite a fairly large number of studies devoted to the problem of implementing competence-based approaches in educational institutions, there are contradictions between the need for a physics teacher capable of solving new professional tasks and the underdevelopment of the system of preparation for their solution.

These prerequisites allowed us to formulate the problem and purpose of the study: determining and substantiating the component composition of functional competencies of students in physics, the formation of General and special functional competencies and internal motivation to a functional position in solving problems; determining and experimentally confirming the pedagogical conditions necessary for the implementation of the maximum success of functional literacy of students in the study of disciplines of the natural science cycle at the University; development and diagnostics of structural components of students ' readiness to solve functional problems in the study of physics.

The purpose of the study determined the setting of the main research tasks:

- analyze modern scientific approaches and requirements to the functional competence of students, clarify its concept and content for the discipline of physics;
- To identify the features of functional competence of students on the example of teaching physics;
- Determination of indicators and criteria of students' readiness for functional literacy in the study of physics;
- Experimental identification of positive/negative changes in the indicators of functional literacy of students as a result of the implementation of the developed pedagogical conditions.

Research hypothesis: the productivity of students ' functional literacy in the process of studying physics is provided if:

- The content and characteristics of the student's functional abilities are explained;
- Certain subjects of the natural science cycle (for example, physics) are defined and take into account the totality of educational conditions necessary for productive functional literacy of students;
- Determines indicators and criteria of readiness for students' academic performance in the study of subjects of the natural science cycle.

2. Materials and methods

Method of research

Scientific methods used to solve the tasks set during the study:

- theoretical: conducting comparative work on research work on a similar topic; To find out the degree of interest of the international academic community in functional competence, the scientific literature is analyzed using two main citation indexes used worldwide to measure

research results: Web of Science and Scopus. More than 50 papers on this topic were identified in both databases.

- empirical methods: direct and indirect pedagogical observation, testing, questionnaires, product analysis, expert evaluation, self-assessment, experimental work. These methods were aimed at identifying the degree of formation of the main components of readiness for functionality and identifying the optimal didactic conditions that stimulate the development of functional competencies. While investigating the components of functional competence that we identified, we used questionnaires that we developed to interview students.

- statistical: mathematical and statistical data processing; The student's t-criterion was obtained in order to determine the statistical significance of the difference in average values ($p = 0.01$). Identification of differences in quantitative indicators obtained based on the results of a pedagogical experiment, we used a nonparametric χ^2-criterion with a probability of an acceptable error of 0.01.

The research was conducted at the Khoja Akhmet Yassawi International Kazakh-Turkish University, M. Auyezov South Kazakhstan state University. A total of 86 students aged 18 to 20 years took part in the experiment (Table 1). The number of participants in the forming experiment is 86 people (including the control group – 42 students, the experimental group – 44 students).

Table 1. Detailed information about the student participating in the experiment

Group	**Number**		**Percentage (%)**	**Total**
Experimental	44		51 %	86 (100 %)
Control	42		49 %	
Gender	female (51)		59 %	86 (100 %)
	Control 24	Experimental 27		
	male (35)		41 %	
	Control 18	Experimental 17		

The research was carried out in three stages:

At stage 1, the research problem is substantiated and the scientific literature is analyzed, a generalizing work on pedagogical experience is carried out, in accordance with the hypothesis, the purpose of the study and the expected result are determined.

At the 2nd stage, a study of the current state of the formation of functional competence of students was conducted. Work has been carried out on the development of technology for the development of the educational environment for the productive functional competence of students in physics. The indicators of functional competence are determined, the factors and pedagogical conditions affecting its formation are determined. A pedagogical experiment was conducted.

At the 3rd stage, the structuring and refinement of the experimental data obtained was carried out, the processing and generalization of the research results were carried out, conclusions were formulated.

3. Results

A large amount of scientific material has been accumulated for the effective organization of work on the formation of functional competence of students at various levels of pedagogical education. The results of the literature analysis made it possible to determine the pedagogical conditions for the implementation of this task. Based on this, we have developed an algorithm for organizing the formation of functional competence of students:

- formation of interest in a specific scientific problem in the field of physics;
- creating conditions in the process of teaching physics in which the student wants to learn in a new direction and acquire some skills at the moment;

Analyzing the above studies, we believe that the results of functional literacy of students depend on many factors (Table 2).

Table 2. Factors of success of functional literacy of students

Factors of success of functional literacy of students	
Subjective	Individual characteristics of students
	The level of preparedness of the student
Objective	The conditions of the educational environment
	Organization
	Diagnostics and control of the student's functional literacy
	Information environment

In order to achieve high performance of students ' functional literacy, it is necessary to create special pedagogical conditions.

We consider the necessary pedagogical conditions for the formation of functional literacy of students in a complex: organizational; didactic; installation-target; logical-structural; diagnostic-effective (developed by T.V. Argusmanova) (Figure 1).

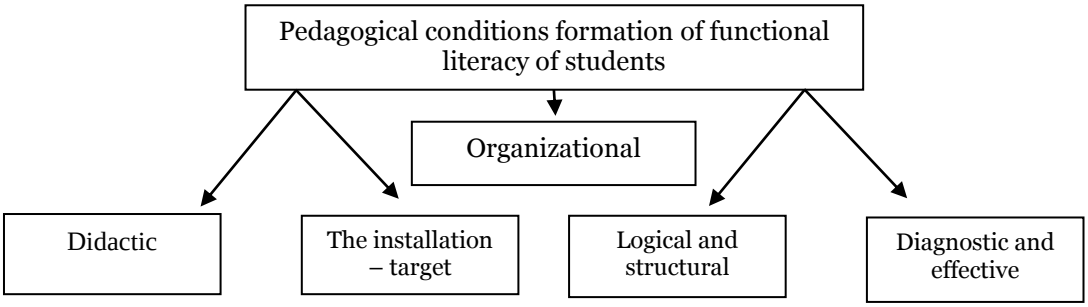

Fig. 1. Pedagogical conditions for the formation of functional literacy of students

- organizational: to determine the features of the formation of functional literacy in higher educational institutions, a general understanding of the functional competence of students in accordance with the disciplines of the Natural Science direction, the main criteria for selecting materials for their own research; to understand logical and structural, educational-didactic and effective teaching situations;
- setting and target: orientation of the goals and objectives of the educational process to the formation of functional literacy of students.
– the logical framework: ensuring cross-curricular links in the teaching of natural Sciences; development of educational technology, involving some stages in the formation of functional literacy in the study of physics; the implementation of subject-subject interaction between teacher and learner in the research process;
- didactic: Introduction of new teaching methods into the educational process; development of students ' functional literacy based on the use of a set of techniques.
- diagnostic and effective: primary diagnostics (identification of students ' motives to engage in research activities, learning goals); diagnostics levels of functional literacy in the process of studying natural science subjects in accordance with the developed criteria (Table 3).

In accordance with modern educational requirements, we note the need to develop the basic concept of functional literacy of students in each university and its relevance.

The proposed structure of student readiness developed by the authors assumes the necessary relationship and interdependence of all components and criteria indicators of components. The overall readiness for functional activity of students is determined by such levels as low, medium and high.

Table 3. Structural components and criteria indicators of functional competencies

Structural components	Criteria indicators
Motivational-Value	Motivation of teaching and cognitive activity, curiosity about physics; the desire to learn new things; independence in the process of teaching, decision-making and evaluation.
Emotionally-Strong-willed	Emotional (positive) attitude to study (inspiration) and research (creative impulse); ability to overcome cognitive difficulties.
Intellectually-Educational	The level of intelligence; the ability to cognitive reflection.
Practical	Ability to set problematic and search questions and problem problem; ability to put forward hypotheses; goal; determine the subject; ability to structure the material; skills to conduct an experiment; knowledge of methods of action in non-standard situations; ability to extract knowledge from reality; ability to state the course, results of work; ability to classify facts;

Thus, the organizational and pedagogical conditions identified by us for the formation of functional literacy of students in the process of studying natural Sciences allow us to proceed to the empirical study of the solution of the research problem.

Results of an experimental study

In our study, we applied a natural formative experiment conducted in the conditions of the educational process in a General education institution during the course of regular and extracurricular activities. The experiment required the necessary organization of the process based on the identified pedagogical conditions.

To test the hypothesis about the statistical significance of the difference in average values, the student's t-test was used at a one-percent confidence level (p=0.01). To identify the differences between quantitative indicators obtained as a result of a pedagogical experiment, we used a nonparametric χ^2-test with a 0.01 error probability. Tables 4–6 were used to visually represent experimental data.

Table 4. Dynamics of readiness for functional activity in students of the experimental group

Components of readiness for functional activity	Start of the experiment (in %)			End of the experiment (in %)		
	High level	Average level	low level	High level	Average level	low level
Motivational-value approach	13	64	23	40	60	0
Intellectual and cognitive	13	60	27	36	60	4
Emotional-strong-willed	9	68	23	36	60	4
Practical	13	55	32	45	55	0

Table 5. Dynamics of readiness for functional activity in students of the control group

Components of readiness for functional activity	Start of the experiment (in %)			End of the experiment (in %)		
	High level	Average level	High level	Average level	High level	Average level
Motivational-value approach	14	66	20	19	71	10
Intellectual and cognitive	14	57	29	19	61	20
Emotional-strong-willed	5	72	23	10	76	14
Practical	14	57	29	19	57	24

Table 6. Dynamics of readiness for functional activity in students of the control and experimental groups

Components of readiness for functional activity	Level	Before experiment (in %)		After experiment (in %)	
		TG	EG	TG	EG
Motivational-Value Approach	High	14	13	19	40
	Average	66	64	71	60
	Low	20	23	10	0
Intellectual and cognitive	High	14	13	19	36
	Average	57	60	61	60
	Low	29	27	20	4
Emotional-Strong-Willed	High	5	9	10	36
	Average	72	68	76	60
	Low	23	23	14	4
Practical	High	14	13	19	45
	Average	57	55	57	55
	Low	29	32	24	0

The empirical value of criterion χ^2 equal to 36.7 exceeds 0.01 with a permissible error probability of 13 %. Determination of levels by this motivational-value component of the distribution of students of control and experimental groups, statistical analysis with the help of Criterion χ^2 shows the importance of differences between the control and experimental group at the final stage. As well as a final study between the distributions of the experimental group in the initial and experimental group (χ^2empir. =77.59).

Consequently, as the results of statistical analysis showed, in the experimental group the number of students with a high level of motivation and value component increased by 21%.

In addition, our study based on empirical analysis showed that there are statistically significant differences in the performance of students in two groups, that is, in the control and experimental groups, according to the levels of the intellectual and cognitive component (χ^2empir. = 25.8, confidence of 0.01).

The presence of differences is also observed between the indicators of the experimental group in the initial and final observations according to the principle of significance (χ^2empiric = 55.77). Consequently, it is observed that the number of students who showed low results according to this component decreased by 16 % at the end of the experiment and a high level by 26 % is convincing.

4. Discussion

The lack of a diagnostic method by which it is possible to assess the level of formation of the studied competence creates difficulties in the full implementation of the formation of functional competence. Diagnostics will be aimed at identifying strengths and weaknesses, potential abilities and needs in the professional activities of the teacher. In addition, it allows you to identify difficulties in the implementation of the educational process and solve it.

The method of diagnosing the level of formation of functional competence requires a scientific basis and clear Organization, an open procedure (Guduru, Bommanaboina, 2021).

These results are in line with the research results of Quitadmo and Kurtz (2007) and Fuad et al. (2017) reporting that the application of different learning models had a higher effect size on the achievement of students' key competencies skills than that of the students taught by using the conventional learning (Quitadmo, Kurtz, 2007; Fuad et al., 2017). The research by Tran, Dat Tran, (2013) showed that the integration of learning models was proven to be effective in improving students' skills, on the other hand, the conventional learning is proven not to empower students' skills (Tran, Dat Tran, 2013).

The considered examples show the complexity and ambiguity of determining the level of formation of qualifications. Despite the difference in the calculation of quantitative characteristics indicating the level of qualification formation, most methods mainly use tests, questionnaires and expert assessments. The analysis shows that not every researcher can use this method due to the

complexity of the procedure for conducting and calculating the competencies under study, due to the narrow direction, which is the formation of competencies in certain academic disciplines, therefore, work continues to create a relatively simple method for establishing the level of formation of professional competencies.

This study is limited to the problems of the formation of functional competencies of students on the example of physics. The factors and pedagogical conditions influencing the formation of the identified functional competence are recommended to be used in all disciplines in the specialty physics, and this will allow to achieve good research results in the future.

5. Conclusion

The program developed and tested by us for the development of indicators of functional competence and organization of functional activities of students:

- improving the factors that influence the formation of functional competence: the ability to understand intentions, methods and actions to perform tasks based on functional competence; the ability to understand and express thoughts that require action; the ability to be creative or creative; the ability to overcome cognitive difficulties; a positive attitude towards planning work; the ability to sort out physics knowledge; the ability to be independent; the ability to conduct research taking into.

- development of a positive attitude to functional activity in the field of physics, the student's motivation to engage in research activities, skills in applying scientific methods in research and progress in a number of physics disciplines. The analysis of the obtained data on the results of the program implementation shows a stable dynamics of the level of development of educational, cognitive and creative research criteria indicators.

So, the results of the study will serve as an excellent scientific document for subsequent research in the field of functional competence, and will also have a huge impact on the development of science and technology, if viewed from the side of professional activity.

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The Use of Mobile Tools when Implementing the Master's Degree Program "Adaptive Physical Rehabilitation" to Improve the Quality of Students' Professional Training

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Abstract

Training of professionals capable of carrying out activities in physical rehabilitation involves acquisition of knowledge and practical skills in the field of using sports and pedagogical technologies for active formation of health of individuals with special needs. New digital educational services allow creating additional conditions for optimizing financial resources, reducing the time for training and retraining of specialists. The purpose of the study is to identify the possibilities of using mobile tools when implementing the master's degree program "Adaptive Physical Rehabilitation" to improve the quality of students' professional training.

The methodology is based on the analysis of the potential of mobile tools for implementing initiatives and government programs for development of inclusive education, support for physical rehabilitation. The authors developed testing which consists of two blocks "Digital tools of professional activities", "Theory and methods of physical education".

Research results. Groups of mobile applications which help to create additional conditions for improving the quality of student training were identified: for training at home and for fitness, for optimizing nutrition, assessing the state of the body, organizing a system of physical exercises for children, dosing loads.

In conclusion, the features of preparing students of the master's degree program are described: creating and maintaining a high level of motivation by means of mobile technologies; consistency and alternation of intellectual work with software and motor activities; social orientation of classes, etc.

Keywords: inclusive education, physical rehabilitation, adaptive sports, digital technology, mobile learning, professional activities.

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1. Introduction

According to UNESCO research, mobile technologies can significantly expand and enrich the range of tools for learning, development, maintaining a healthy lifestyle in different socio-demographic groups (Rekomendacii YUNESKO..., 2023). Experts from international organizations are developing draft recommendations that will help digital school educators understand what m-learning is and how to use the unique capabilities of mobile applications to implement the fundamental principles of inclusive education (Becker et al., 2020). These recommendations can be applied at various levels of education and in its various forms: at universities, cultural and sports centers, institutions of technical and vocational education.

In addition, there are a number of fundamental international legal documents that ensure the introduction of inclusive education in Russia (Inklyuzivnoe vysshee..., 2023): the Universal Declaration of Human Rights, the Convention on the Protection and Promotion of the Diversity of Cultural Expressions; Convention on the Rights of Persons with Disabilities, etc.

The legislation of the Russian Federation develops and concretizes the norms of international law concerning the realization of the right to receive education by disabled people and persons with disabilities. Thus, the provisions of the Federal Law "On Education in the Russian Federation" introduce the concept of an adapted educational program, substantiate the need to develop and apply special pedagogical approaches, methods, and technical means (Federal'nyj zakon..., 2023).

Within the framework of the existing regulatory framework, I. V. Mikhailova, A. I. Seselkin, A.S. Makhov, M.V. Eremin propose to diversify the content of training the master's degree students in adaptive physical culture as an option for the introduction of innovative technologies for additional professional education, which allows not only to significantly save financial resources, but and reduce the time for training new specialists (Mikhailova et al., 2015).

According to the Federal State Educational Standard of Higher Education, the main types of professional activities for students of the training program "Physical culture for persons with health limitation (adaptive physical culture)" are: pedagogical; educational; developing; rehabilitation (recovery); compensatory; preventive; research; organizational and managerial (Federal'nyj gosudarstvennyj..., 2023).

To achieve the set goals professionally-oriented events are held at universities using modern interactive educational technologies. For example, the Nizhny Novgorod Pedagogical University named after K. Minin held an inclusive event "Healthy lifestyle – the eighth wonder of the world!". It was organized in the format of a quest aimed at manifesting sociability, responsibility, independence and team interaction among students in adaptive physical culture. As part of the quest, students with disabilities received the opportunity for intellectual and creative self-realization. An inclusive bus trip "Memory Road from Moscow to Brest" was organized at the Russian State Social University (Inklyuzivnoe vysshee..., 2023).

V.M. Kirillina et al. note that the practice of Russian universities in the preparation of professionals capable of carrying out activities in the field of adaptive culture is characterized by:

- developing of complexes of special physical exercises (adaptive physical culture and therapeutic physical culture);
- using modern sports equipment;
- bringing the information educational space in line with the requirements of accessibility, reliability, strength, convenience and principles of creating a barrier-free environment for various categories of students with limited health capacities (Kirillina et al., 2017).

However, as E.I. Sheenko, N. N. Ryzhkova note that future and current specialists in adaptive physical culture experience certain methodological difficulties in the implementation of professional activities in inclusive conditions in the following situations (Sheenko, Ryzhkova, 2021):

1) when developing electronic didactic materials for independent work of students;

2) when implementing adapted means (computer games, interactive exercises, etc.) in the classroom;

3) when selecting and/or developing the content of tasks of a research and creative nature in the digital environment.

The hypothesis of the study is that the use of mobile tools when teaching master's degree students of the training program "Adaptive Physical Rehabilitation" will improve the quality of their professional training.

2. Relevance

2.1. Literature review

The analysis of literary sources and scientific and methodological materials was carried out in the following areas:

–potential of mobile technologies for inclusive education;

– foreign and domestic experience in the use of mobile tools for physical rehabilitation;

– problems and prospects for the inclusion of mobile tools in the training of specialists in adaptive physical culture and sports.

2.1.1. Analysis of Russian scientific and pedagogical literature

L.N. Eidelman considers modern problems of social rehabilitation of the disabled, active involvement in socially useful activities of people with health limitations (Eidelman, 2022). The author notes that they cannot be solved without their physical rehabilitation, adaptive physical education and other available activities. Using innovative methods and technologies, it is possible and necessary to increase the motivation of students, to reveal their creative abilities (Soboleva, Karavaev, 2020). It confirms the relevance of the problem of improving the master's program in adaptive physical culture.

The work of A.V. Aksenov, E.B. Ladygina, I.G. Kryukov, A.A. Grachikov explores the possibility of using mobile applications for organizing testing (Aksenov et al., 2023). Testing tools are used in the format of the All-Russian physical culture and sports complex "Ready for Labor and Defense".

The authors substantiate the need to strengthen the scientific and methodological work to increase the level of motivation of the disabled to systematically engage in adaptive physical culture and adaptive sports and come to the conclusion that adaptive physical culture is a relatively new direction in social practice. The authors conclude that the problem of developing and implementing health-saving technologies for training and education is one of the most relevant in modern science and practice.

A. M. Kononov, S. K. Kononova, T. K. Davydova and others note that one of the most important requirements of today is the development of methodological foundations of adaptive physical culture, the fundamentalization of education in this area (Kononov et al., 2020). The main problem here is not the accumulation and integration of knowledge in physical culture, medicine, correctional pedagogy and a large number of previously listed educational and scientific disciplines. The problem lies in the scientifically based and methodically verified introduction of innovative technologies for inclusion, which allow optimizing financial resources, reducing the time of training and retraining of specialists.

A.I. Laskova, M.Yu. Frolov, Yu.A. Orlova, Yu.M. Lopatin present the results of the study according to which mobile applications help create a more accessible development environment for people with reduced capabilities (Laskova et al., 2022). For example, after an injury, stroke.

B.E. Gornyy, A.S. Bunova, D.V. Kushunina et al. conduct the expert assessment of mobile applications for smoking cessation using a methodology recognized in the international scientific community (Gornyy et al., 2022). The authors note that most applications are characterized by high functionality. Aesthetics, which is more of a technical aspect of app development, also got pretty high marks. At the same time, such important parameters as the involvement of students and the information content of the mobile application received the lowest scores.

The digitalization of modern society, the variety of electronic learning and development tools available in the inclusive educational environment, give rise to the need to revise approaches to the implementation of master's degree training programs 49.04.02 Physical culture for people with health limitations (adaptive physical culture).

So, according to I.V. Mikhailova, A.I. Seselkin, A.S. Makhov, M.V. Eremin, teachers of higher education do not pay due attention to the problems of improving the training of highly qualified specialists in the new socio-economic conditions and a transformation of the set of studied in academic disciplines is required (Mikhailova et al., 2015).

Thus, to date, the system of higher education has developed a certain approach to the design and implementation of the master's training program "Physical education for persons with health limitations (adaptive physical education)", which is characterized by the following aspects:

1) the educational content of the master's degree program subjects should not contain isolated information from various fields (physical culture, medicine, etc.), but a systematized material formed in the course of implementing the integrative approach to the study of various

subjects and focused on preparing students for professional activities in accordance with Federal Educational Standard of Higher Education;

2) the program belongs to the academic magistracy, it is a logical continuation of the bachelor's degree program and is aimed at deeper training by expanding professional competences.

The analysis of the above scientific papers reveals the problem associated with the need for additional study of the use of mobile tools and applications when implementing the master's degree program to improve the quality of students' professional training.

2.1.2. Analysis of foreign studies

The processes associated with the formation and development of the digital economy, according to S. Bećirović, M. Dervić, inevitably affect the development of educational systems around the world (Dervic, Bećirović, 2019). Diffusion of digital technologies into all spheres of human activity, including inclusive education and upbringing, is observed everywhere.

Y. Qiu, G. Zhang note that the goal of the youth physical education is not only mastering a complex of sports knowledge and skills (Qiu, Zhang, 2020). The most important thing, according to the authors, is the creation of conditions for self-realization of the future specialist, self-development and manifestation of creative skills. Such an understanding of the goals of physical education is of particular relevance in the context of inclusive education. The indicated goals can be achieved through the use of such innovative means of adaptive physical culture as specialized mobile applications (Levinet al., 2022). A number of studies have been conducted that testify to their effectiveness in conducting classes for people with helth limitations, including Down syndrome, autism, and spina bifida.

S. Amez, S. Baert determine that modern education based on mobile learning is becoming not just a part of social life, but the result of significant transformations and changes that have taken place in the society (Amez, Baert, 2020). Digital technology is a systematic set and procedure for the functioning of all personal, instrumental and methodological means used to achieve pedagogical goals.

In the course of the systematic analysis of the literature, scientists come to the conclusion that the introduction of mobile devices in the educational process is accompanied by problems of a didactic and informational nature. For example, there is a possibility of a user becoming addicted to a mobile phone. Also S. Amez, S. Baert point out the objective difficulties associated with the allocation of the main components of mobile learning tools; determining the content and types of cognitive activity offered by its applications (Amez, Baert, 2020).

However, as S. Amez, S. Baert conclude, researchers and practitioners must constantly search for the most advanced and modern methods and technologies of mobile learning (Amez, Baert, 2020).

J. Hanus et al. explore the possibilities of using modern digital technologies in the physical education of students in the educational environment of the university (Hanus et al., 2013). According to their conclusions, a mobile device in the capable hands of a specialist, including a physical education teacher, becomes an effective teaching tool. Thus, the use of mobile applications in the field of physical culture and sports is becoming a new trend in the field of education, including inclusive education (Slot et al., 2019).

P. Strojny, N. Dużmańska-Misiarczyk substantiate that in the modern information space, mobile devices (phones, tablet computers, AR/VR devices, smart watches) can act as innovative learning tools that generate new didactic possibilities of the digital educational environment built on their basis (Strojny, Dużmańska-Misiarczyk, 2023).

S. Becker, P. Klein, A. Gössling, J. Kuhn indicate that technological advances in the digital society open up new opportunities for using mobile devices to enrich the learning environment with interactive multimedia content (Becker et al., 2020). The authors suggest using tablets to study various features of movements of the human body using a mobile application that provides the opportunity to take measurements and record their results in several data sets.

In addition, according to Ch. Liu et al., mobile educational applications act as a tool for increasing motivation, the emergence of new ways of presenting and transmitting information, activating cognitive interest, intensifying feedback, improving the educational process and managing it using innovative technologies (Liu et al., 2021).

C. Foissey et al., studying the medical aspects of the use of mobile applications for planning and monitoring physical activity by people with health limitations, note that this helps prevent injuries during training and prevent aggravation of disability (Foissey et al., 2021).

T. Hees et al. substantiate that the advent of mobile ultrasound scanners makes it possible to perform ultrasound on a patient with an injury both in a medical institution and in the place of primary care (Hees et al., 2020). Therefore, familiarity with such portable devices should be included in the master's degree training programs.

So, the analysis of foreign literature allows us to objectively state that mobile applications in the field of adaptive physical culture and sports have the following didactic potential: support for physical rehabilitation processes, motivation support, socialization of students with special educational needs, etc.

The use of mobile applications when implementing the master's degree program can help create additional conditions for improving the quality of students' professional training.

2.2. Purposes and objectives of the study

The purpose of the work is determined from the need to study the possibilities of using mobile tools when implementing the master's degree program "Adaptive Physical Rehabilitation" to improve the quality of students' professional training.

The following were identified as the main objectives:

– substantiate the content of the discipline "Digital tools of professional activities" and the means of its implementation in the form of mobile applications, within which graduate students will gain experience in using digital tools, including mobile applications, in their professional activities;

– identify and characterize the main thematic sections of the discipline;

– describe the stages of work on the use of mobile tools to promote the principles of a healthy lifestyle and the values of inclusion;

– experimentally test the effectiveness of the proposed option to improve the content of the master's program.

3. Materials and methods

3.1. Theoretical and empirical methods

To achieve the purpose and the objectives of the study, the following methods were used:

– theoretical: analysis and generalization of normative legal acts, scientific and methodological literature on the issues of training teachers of physical culture, as well as inclusion; comparative analysis of the curricula of master's degree programs in various universities.

– empirical: observation of the information interaction of participants in the educational process, pedagogical experiment, testing;

– methods of mathematical statistics.

Studying and using mobile applications when implementing the master's degree program "Adaptive Physical Rehabilitation" is carried out within the framework of the discipline "Digital tools of professional activities".

In the course of the pedagogical experiment the analysis of the activities and generalization of the experience of students working with mobile applications was carried out for the following groups: for training at home and fitness, for optimizing nutrition, assessing the state of the body, organizing a system of physical exercises for children, dosing loads.

To process the results of the experiment questionnaire-diagnostic methods (observation, conversation, generalization, testing, and assessment) were used.

Testing which consists of two blocks was developed: "Digital tools of professional activities" (30 questions), "Theory and methods of physical culture" (30 questions).

The same teacher used mobile educational tools when implementing the master's degree program to comply with the rules of probabilistic selection of subjects.

The study involved 42 students of the Vyatka State University of the training program 49.04.02 Physical culture for people with health limitations (adaptive physical culture) training program specialization "Adaptive physical rehabilitation".

At the stage of statistical processing of the changes that have occurred in the pedagogical system the Pearson's chi-square coefficient – $\chi 2$ was used.

3.2. The base of research

The main purpose of the experiment was to test the didactic potential of mobile devices when implementing the master's degree program "Physical culture for people with health limitations

(Adaptive physical culture)", training program specialization "Adaptive physical rehabilitation" to improve the quality of students' professional training.

The experimental and search work was carried out on the basis of the Vyatka State University (Faculty of Physical Culture and Sports). Students of the program have work experience in educational institutions of general, professional, additional education; in sports and recreation and rehabilitation centers; medical and preventive organizations, fitness clubs.

The experiment involved 42 master's degree students (52 % male, 48 % female). The average age of the respondents is 25.

The sample size is determined by the specifics of the training program.

As a rule, those students who are aware of the importance of rehabilitation activities for people with health limitations start the master's degree. Before and after the experiment, the assessment of the level of professional training of graduate students, according to the principles and materials stated in 4.3.1, was made.

The test questions were developed in accordance with the Federal State Educational Standard of Higher Education in the field of study, included in the fund of assessment tools of the relevant disciplines, agreed and approved as part of the work program of the discipline.

3.3. Stages of research

At the first stage of the study, the analysis and generalization of normative legal acts, scientific and methodological literature on the issues of training PE teachers, as well as inclusive education was carried out. The comparative analysis of curricula of educational programs of universities regarding the use of mobile technologies in sports, medicine, and education was carried out.

Further testing of 42 master's degree students of the Vyatka State University (Faculty of Physical Culture and Sports) of the training program: 49.04.02 Physical culture for people with health limitations (adaptive physical culture) was carried out.

The total number of questions in the test bank is 60, out of them 30 questions are related to "Digital tools of professional activities" and the other 30 questions are related to "Theory and Methods of Physical Culture". Their examples are presented in 4.3.1.

Each task of the test in case of correct answer is estimated at one point. Thus, as a result of the initial diagnosis, each student scored from 0 to 60 points. The levels "low" (from 0 to 29 points (inclusive)), "average" (from 30 to 50 points (inclusive)), "high" (more than or equal to 51 points) were introduced to determine the level of professional training. Interpretation by levels of professional training is presented in 4.3.1.

Thus, it was possible to collect data on 42 students of the training program adaptive physical culture and sports. The control (21 graduate students) and experimental (21 graduate students) groups were formed based on the materials of the conducted testing.

At the second stage of the study, the theoretical and accumulated empirical experience was systematized in terms of the problem stated. The selection of mobile applications for various systems of physical culture and rehabilitation was also carried out. When analyzing services, intellectual, emotional and social components were also taken into account.

At the third stage of the study the main conclusions and recommendations on the use of digital technologies (including mobile applications) for the scientific and methodological support of the learning process in adaptive physical culture, rehabilitation activities of people with health limitations were formulated.

4. Results

4.1. Key concepts of mobile learning for master's degree students in the field of adaptive physical culture and sports

In the course of analytical activities the authors found that the state gives great attention to the problems of rehabilitation of people with health limitations, including by the means of adaptive physical culture. For example, in 2021 Russia adopted the Concept for the Development of the Comprehensive Rehabilitation and Habilitation System, designed for a period up to 2025. Its goals are the development of inclusion and social adaptation of people with health limitations in various areas of life, as well as support for adaptive sports (Rasporyazhenie Pravitel'stva..., 2021).

Directions of the state policy in the field of medical, social and psychological-pedagogical services are:

– formation of an active lifestyle of citizens with health limitations, their inclusion in social life;

– improvement of the medical and social expertise service and the procedure for developing and implementing an individual rehabilitation or habilitation program (IPRA).

In addition, the analysis of the literature revealed that the software for monitoring health and rehabilitation indicators is also being modified. For example, Big Data and cloud computing are used.

To implement these initiatives the society needs highly qualified specialists who are able to work not only with healthy athletes, but also with those who have health limitations (diseases, injuries, etc.).

Universities train specialists of this level within the framework of the master's degree program "Physical Education for Persons with Health Limitations (Adaptive Physical Education)", training program specialization "Adaptive Physical Rehabilitation". The program is aimed at mastering the system of improving sports culture and mastering modern methods of rehabilitation and training of people with various forms of pathology.

It is stated that the specific labor functions of a specialist in adaptive physical culture include: conducting physical education classes for people with health limitations or for the prevention of various health disorders; training and preparing competitions of Paralympic athletes – professionally involved in sports with the disabled; organization of leisure, correctional, health-improving and rehabilitation activities for persons with health limitations; carrying out research work.

It is determined that the work of a specialist in adaptive physical culture and sports involves using motor activities to correct health disorders and social adaptation of people with various severe pathologies.

As part of the master's degree program the following skills and competences are formed:

– implementation of rehabilitation activities and development of physical rehabilitation programs;

– possession of body recovery technologies and methods of teaching people with health problems;

– scientific, methodological and informational support of the learning process for the main activities in the field of adaptive physical culture;

– assessment of the applicability and effectiveness of software tools, identification of problems of their use for adaptive physical culture;

– conducting scientific research to resolve problem situations in the field of adaptive physical culture using modern digital technologies, including mobile applications.

The mobile application in the presented study is a program installed on a platform that has functionality in terms of physical development and education. It allows performing various types of actions (exercises, tasks, games, etc.). Mobile applications are considered by the authors as a multifactorial socio-cultural synthesis of science, art, communication and sports.

4.2. Practical work on the use of mobile tools to promote the principles of healthy lifestyles and the values of inclusion

The study and use of mobile devices was carried out by students during classes of the discipline "Digital tools of professional activities". The teacher created additional conditions which help the formation of digital literacy of future specialists, the development of digital skills that are most in demand in inclusive education.

The main sections of the discipline were aimed at the study and application by future specialists in adaptive physical culture: hardware and software systems used in the field of sports and recreational educational practices; information and communication technologies; digital services and mobile applications.

The work program of the discipline includes the following topics:

1) hardware and software complex (hereinafter referred to as HSC): purpose and types;
2) principles of work of HSC, collection, storage and analysis of the results;
3) devices with biofeedback, the principles of their use;
4) HSC for studying the nervous system and higher nervous activity;
5) HSC for studying the musculoskeletal system;
6) HSC for studying the cardio-respiratory system;
7) analysis of the application of HSC and biofeedback devices;
8) digital applications for physical culture;
9) the concept and classification of mobile applications;

9.1) home workout applications;
9.2) fitness applications;
9.3) nutritional optimization applications;
9.4) applications for assessing the state of the organism;
9.5) applications for training children;
9.6) applications for building workouts and dosing loads;
10) digital support services for inclusive education. In particular, it was determined that for people with health limitations it is advisable to use applications for relatively "easy" sports; applications with workouts for pilates, stretching and yoga are popular.

Master's degree students of the experimental group analyzed several types of innovations in the field of mobile technologies.

I group. Applications for training at home ("Workouts for home", Fitness Online, My coach, FitStart, Fitness for girls).

II group. Fitness applications (Woman, Slimming Fitness; 30 Days Fitness at Home; Adidas Training; FitProSport).

III group. Nutrition optimization applications (FatSecret Calorie Counter; Lifesum: Healthy Eating; PEP: Eating Plan & Diary; Lifesum; YAZIO).

IV group. Applications for assessing the state of the body (Yandex.Health – online doctor, Welltory: My health and pulse; My Health: Lifestyle; Cardio Journal). Nutrition optimization was also performed using text and spreadsheet applications on smartphones and tablets.

In general, the optimal diet problem was formulated as follows: "There are N types of food that contain T types of nutrients (proteins, fats, carbohydrates). One weight unit of the product of the i-th type contains a_{ij} units of the j-th type of nutrient. The minimum daily requirement b_j of a person for each type of nutrient is known. The calorific value c_i of one weight unit of the i-th product is given. It is required to determine the optimal composition of the diet of products, such that each nutrient is contained in it in the required amount that provides the daily human need, and at the same time the total caloric content of the diet is minimal".

Group V. Workout applications for kids (SpinMe Alarm Clock, Morning Exercise for Kids, Lil Fitness, Kids Fitness - Daily Yoga).

VI group. Applications for building workouts and dosing loads (Jefit, Gym Boom, Pocket Trainer, WODster).

Let us present the results of the analytical activities of the master's degree students with the methodological recommendations developed by them.

1. Application "FatSecret". The service allows the user to select the daily need for calories, has a built-in recipe book, which can be supplemented if desired.

The application has "flexible" filters (calories per serving, macronutrient content). They allow you to find and choose the recipe for the best dish.

The built-in calendar helps you track your daily calorie intake (breakfast, lunch, dinner, snack) and keep a food diary.

The application provides the possibility to track sleep time and time spent exercising. However, according to the students of the experimental group, the disadvantage of this mobile application is that this information must be entered manually.

In order to start using the application you must enter your date of birth, weight, height, gender, and your physical activity, then indicate the goal (gain weight, lose weight or maintain it at the current level).

Another disadvantage of this application, according to the students, is that Premium access is required to use all the functions. Only it gives the possibility to track not only the main meals, but also water consumption.

2. Application "Yazio". To use "Yazio" you must enter the following information: date of birth, weight, height, gender, physical activity, goal.

The application offers to keep a diary. Yazio automatically calculates the number of calories (breakfast, lunch, dinner, snack) needed to reach your goal. The amount of drunk water (entered manually) can also be tracked. Filters (vitamins, minerals macro and micronutrients) allow choosing the optimal type of nutrition. The application takes into account the preferences of the user (whether the user is a vegetarian or follows a classic diet). "Yazio" has features that allow tracking the number of steps taken. The user can also enter this data manually.

A significant advantage, according to the students, is that it is proposed to indicate intermediate and short-term goals in the application. This has a positive effect on motivation.

3. Application "My Health – Lifestyle". The service contains a calendar that allows adding events. The following indicators can be tracked: sugar, pressure, heart rate, height, temperature and weight. Or a new indicator can be added, the changes of which should be monitored further.

In the diary it is possible to fill in a table of taking certain drugs. This allows controlling their intake (name, form of release, dosage, duration of the course). In addition, this application allows displaying notifications about the need for a timely intake of the drug.

Recommendations of the students: it can be used as an alternative or addition to a paper health diary.

4. Application "Cardio Journal". This application is designed to view blood pressure values, track medications in the form of a list or graphs. It has an additional function, it can remind when you need to measure the pressure or take this or that drug.

The "Indications" section allows viewing and adding data on blood pressure and drug courses. With the help of filters the user can choose to view individual indicators (morning, afternoon, evening, night).

The "Graphics" section allows building a graph based on the data from the previous section, studying changes in blood pressure for a given time.

The "Reminders" section gives an opportunity to create notifications: when you need to measure pressure or take a particular drug.

Recommendations of the students: the mobile application "Cardio Journal" can be used as an alternative to a paper health diary.

5. The application "PEP: Diet – Diet Diary", according to one of the students of the experimental group, is a unique assistant in changing the diet. The application will make it relatively easy to achieve the goal (weight loss, maintenance or weight gain). The user needs to select one of the nutrition programs. Then the user receives a personalized diet with guidance and recipes for each day.

The application has tools that allow choosing an individual diet program for weight loss or weight gain.

For example, intermittent fasting, ketogenic diet, high protein diet, Mediterranean diet, DASH and MIND diets, chia detox, proper healthy eating, vegetarianism, veganism and raw foodism.

Body parameters can also be tracked – mark own parameters, weight and monitor results and progress.

One of the students began to use this application to restore physical fitness and normalize weight after an illness.

6. Application "Adidas Training: fitness at home." After registration the user needs to complete a survey: the purpose of the classes, the frequency of exercises, indicate the reasons for accessing this application. Also it is needed to clarify the purpose of using the application, height, weight and days of training for the next week. Further, "Adidas Training: fitness at home" automatically plans a set of exercises for each day (exercises are presented in English). The advantages of the application, according to the students of the experimental group, include the fact that it reminds when to start training. There are ready-made standard programs. Progress can also be tracked. The results can be shared with other users. There are various tasks to test yourself. In addition to training, the application offers to create own individual diet.

The master's degree students also recommended it to support a healthy lifestyle.

4.3. Experimental assessment

4.3.1. The ascertaining stage of the experiment

To assess the input conditions (the level of professional training of the master's degree student in the field of adaptive physical culture and sports), the author's testing was developed. The total number of questions in the test bank is 60. Out of them 30 questions are related to "Digital tools of professional activities" and the other 30 questions are related to "Theory and Methods of Physical Culture".

Sample questions from the first block.

1.1. Which of the mobile applications is used in the field of adaptive physical education and sports: "Ostrovok", "Dexteria", "Edadil", "Family Locator".

1.2. Based on a generalization of own experience, indicate the disadvantages of using electronic educational resources in training. Answer options: information overload of the educational process; the possibility of choosing an educational trajectory; some resources require expensive new electronic devices; availability of multimedia content; the complexity of assessing the quality of an electronic educational resource posted on the Internet.

1.3. Select digital services that are used for adaptive physical education events. Answer options: Russian Sports Encyclopedia, Artifex.ru resource, Coaching on-line program, Sigma platform.

Sample questions from the second block

2.1. Name the method based on determining the functional state of the human body systems by measuring the electrical conductivity at the biologically active points corresponding to these functional systems. Answer options: load tests; thermal imaging diagnostics; electropuncture diagnostics; gas discharge imaging.

2.2. Determine the factor that must be taken into account when designing educational results in the academic discipline "Physical Education" for persons assigned to a special medical group. Answer options: nosological group; the age of those involved; restrictions and contraindications to physical activity; all answers are correct.

2.3. A teenager spends most of the day sitting in front of the computer, in the evening there are pains in the back, in the area of the wrist joint, a violation of posture is visible. What recommendations can help reduce pain and improve posture? Answer options: reduce the time spent at the computer; do exercises; do self-massage; observe hygienic requirements when working at a computer, strengthen back muscles, conduct physical exercises.

Each task of the test in case of the correct answer is estimated at one point. Thus, as a result of the initial diagnosis, each student scored from 0 to 60 points. To determine the level of professional training, the levels "low" (from 0 to 29 points (inclusive)), "average" (from 30 to 50 points (inclusive)), "high" (more than or equal to 51 points) were introduced.

The following levels were introduced to interpret the results: "high", "low", "average". Let us describe the essence of the levels in order to evaluate the results of the experimental work later.

Level "High" – the student actively uses digital technologies (including mobile applications) in the scientific and methodological support of the learning process in adaptive physical culture; able to carry out rehabilitation activities and develop physical rehabilitation programs based on sports and pedagogical technologies; evaluates the effectiveness and identifies problems when using digital tools in the implementation of professional activities.

Level "Average" – the student uses digital technologies (including mobile applications) in the scientific and methodological support of the learning process on the main types of motor activities in adaptive physical culture; understands, but does not always take into account the advantages and disadvantages of new digital media; able to carry out rehabilitation activities and develop physical rehabilitation programs based on sports and pedagogical technologies only according to instruction; not in all cases evaluates the effectiveness and problems of using digital tools in professional activities.

Level "Low" – the student is aware of the potential of digital technologies (including mobile applications) to accompany the learning process in the main types of motor activities in adaptive physical culture, however, does not use their capabilities in practice; in most cases, the student does not take into account the advantages and disadvantages of new digital tools; able to carry out rehabilitation activities and develop physical rehabilitation programs based on sports and pedagogical technologies only under the guidance of a mentor; does not think about the problems of using digital tools in professional activities.

Thus, taking into account the results of processing materials, it was possible to collect data on 42 master's degree students in the field of adaptive physical culture and sports, out of them the experimental and control groups were formed.

4.3.2. Forming stage of the experiment

Thus, the content of the educational program of the master's degree program "Adaptive physical rehabilitation" for the discipline "Digital tools of professional activities" included the practical activities of master's degree students in the use of various groups of mobile applications: for training at home and fitness, optimizing nutrition, assessing the state of the body, organizing a system of physical exercises for children, dosing loads.

The students of the experimental group explore the features of the work of these groups of mobile applications, they also evaluate the researched applications according to the following criteria:

– the availability of training materials, the visibility and accessibility of lessons, the possibility to participate in live trainings;

– accessibility in development;

– independence from the place and inventory;

– intelligent recommendation algorithms, individual programs taking into account the characteristics of the body, dynamic adaptive content, personal activity tracker;

– interface design, developers' creativity, flexibility of training mode settings, the presence of a motivational component and aesthetic accompaniment.

So, the master's degree students of the experimental group were involved in information interaction aimed at improving the skills in the use of modern educational, health and sports-oriented technologies for their application in professional activities.

Based on the results of working with mobile applications, the students were asked to complete the following independent task: to characterize each of the mobile tools (applications) according to the following criteria: target audience; the possibility of refinement (adjustment) in the process of use; multilingualism; the difficulty of self-administration. The students presented the results of the work in the form of a table.

The participants in the control group also studied electronic and digital services for physical culture and sports. The social networks used in the country, video hosting, specialized sites, online services for joint training were analyzed.

For example, the digital platform "Sport for me" (https://sportforme.ru/). The platform presents the first steps in choosing a sports facility, sports section, sports event, scientific conferences. However, information is still insufficient. The service has a total of 308 sports facilities. However, for some regions (for example, in the Perm Territory), the mobile application "Sports for Me" was also developed.

Also, the master's degree students of the control group studied the possibilities of digital technologies for gymnastic exercises and games, for the development of the musculoskeletal system. Or registered and interacted with each other through the resources of the digital platform for the field of sports "My Sport." It is an online-platform for athletes and their parents, coaches, sports federations, sports organizations and authorities. As part of their independent work, students developed game control and measuring materials (crosswords, tests, etc.).

However, the students from the control group were not involved in practical work with mobile applications.

4.3. 3. Control stage of the experiment

At the fixing stage of the experiment re-testing consisting of 60 tasks was carried out according to the two blocks described above. Information about the level of professional training before and after the experiment is presented in Table 1.

Table 1. The results of the use of mobile means when implementing the master's degree program "Adaptive physical rehabilitation" to improve the quality of training

Level	Groups			
	Experimental group (21 students)		Control group (21 students)	
	Before the experiment	After the experiment	Before the experiment	After the experiment
«High»	1 (4.76 %)	7 (33.34 %)	1 (4.76 %)	2 (9.52 %)
«Average»	11 (52.38 %)	12 (57.14 %)	12 (57.14 %)	11 (52.38 %)
«Low»	9 (42.86 %)	2 (9.52 %)	8 (38.10 %)	8 (38.10 %)

Hypotheses were accepted: H0: the level of professional training of the students in the experimental group is statistically equal to the level in the control group; H1: The level in the experimental group is higher than the level of the control group. For $\alpha = 0.05$, $\chi 2crit$ is 5.991. Further, $\chi 2obs.1$ (before) and $\chi 2obs.$ (after) the experiment. Thus, we get: $\chi 2obs.1 < \chi 2crit$ (0.102 < 5.991), and $\chi 2obs.\ 2 > \chi 2crit$ (6.421 > 5.991). Therefore, improving the quality of professional

training of the students of the training program "Physical culture for people with health limitations (adaptive physical culture)" can be considered not accidental.

At seminars the difficulties of practical exploitation digital (including mobile) technologies in adaptive physical culture and sports were also identified: the need to adapt devices to a specific type of health disorder; significant cost of HSC and biofeedback devices; it is advisable to take into account the individual qualities of users (sociability/shyness, aggressiveness/friendliness, focused attention/distractibility, etc.).

It should be noted that after performing the qualitative assessment of the test results it was found out that the level "High" in relation to the quality of professional training was determined in 33.34 % of the master's degree students of the experimental group. Initially, this value was equal to 4.76 %. The number of students who have the level "Low" decreased from 42.86 % to 9.52 %. The changes were recorded at the level “Average”: 52.38% before practical activities and information interaction by means of mobile technologies and 57.14% after. The dynamics of results in the control group is not so significant. The level of professional training "High" was recorded in 9.52% of the students. It was 4.76 % initially. For other levels of positive changes were not recorded.

5. Discussion

The materials of the study correspond to the priority areas of activity of UNESCO and the system of Russian education in terms of the development of inclusive education (Rekomendacii YUNESKO..., 2023). Also, the participants of the experiment identified the following advantages of using mobile technologies for inclusive education:

– expansion of opportunities for socialization of the disabled;

– the emergence of additional opportunities for variable transformation of the content of educational material;

– transformation of one type of information into another and strengthening it to ensure information compatibility (for example, the visual representation of the text compensates for hearing deficiencies);

– expanding the range of exercises used in physical education classes and applied by the HSC;

– formation of students' readiness for self-control, rehabilitation at home.

The perspective, in the opinion of the participants of the experiment, is the use of mobile applications that can transform physical education into participation in a computer game.

The obtained conclusions about the potential of mobile technologies for adaptive physical culture and sports complement the results of the work of J.Levin, E. Khokhlovich, A. Vyshedskiy, who summarize innovative international experience (Levin et al., 2022). A significant result of the study is the description of the structure of the discipline "Digital tools of professional activities", which expands the ideas of I.V. Mikhailova, A.I. Seselkin, A.S. Makhov, M.V. Eremin about the need to diversify the content of training master's degree students in adaptive physical culture (Mikhailova et al., 2015).

So, within the framework of the presented study, specialists in the field of adaptive physical culture actively used mobile tools for academic and professional interaction (including in a foreign language).

The master's degree students (for the future) proposed to study another group of mobile applications that support "wearable" technologies in the field of adaptive sports. Such devices are the result of a worldwide trend towards equipment miniaturization. They are effectively used to measure various indicators of movement, physiological signals and parameters. The proposed direction is relevant due to the fact that people with health limitations are increasingly using such assistive devices in everyday life. In addition to fitness trackers and fitness bracelets, electrochemical sensors, microfluids, painless microneedles are actively used.

6. Limitations

Let's pay attention to the possible limitations for the study:

1. The sample of students was not random, therefore, experimental data cannot be generalized for the entire students population.

2. Formation of questions for the authors' testing in accordance with the Federal State Educational Standard of Higher Education in the field of study, the content of the fund of assessment tools of the relevant disciplines and the work program of the discipline. As a rule, those students who are aware of the importance of rehabilitation activities for people with health

limitations start a master's degree. The students of the program have experience of working in children's and youth sports-adaptive schools, adaptive youth clubs of physical training; structural units for adaptive sports in educational institutions; sports and recreation and rehabilitation centers, medical institutions, sanatoriums.

3. An important condition is that throughout the experiment, the same teacher supervised the study and use of mobile devices when implementing the master's degree program "Adaptive Physical Rehabilitation".

7. Conclusion

In the present research the study and use of mobile devices when implementing the master's degree program "Adaptive Physical Rehabilitation" was carried out by students within the discipline "Digital tools of professional activities".

The use of mobile devices in the activities of specialists in adaptive physical culture and sports makes it possible to create additional conditions that provide:

– changing the nature of information interaction between participants in the didactic process in inclusive education;

– social integration for those groups that usually receive little attention in the professional and academic sphere;

– personal development of students, which is manifested in: activities related to the development of academic disciplines; participation in physical culture and rehabilitation activities; improving the structure of professional orientation, professional competence.

The distinctive features of training master's degree students of the training program "Physical culture for persons with health limitations (adaptive physical culture)", training program specialization "Adaptive physical rehabilitation", in the digital society, according to the authors, should include:

1) creation and maintenance of a high level of motivation by means of digital (including mobile) technologies;

2) consistency of intellectual and motor activities;

3) continuity of the processes of self-development and self-education of the future specialist (for example, mastering of innovations in the direction of virtual reality and augmented reality for physical rehabilitation);

4) social orientation of classes.

A significant advantage of mobile applications is the possibility to increase motivation for sports. Individuals with special educational needs, being limited in access to various types of motor activities, often lose interest in sports. The inability to access the relevant infrastructure also affects motivation. These problems can be solved through the use of sports mobile applications.

Currently, there is no single database of mobile applications to stimulate the physical activity of users. However, the promotion of a healthy lifestyle, physical culture and sports in the inclusive educational environment should be carried out not only within the classroom, but also in extracurricular activities.

Thus, practical activities and interaction through mobile applications in the presented study allows master's degree students to reach the innovative level of using information technologies in inclusive education: transformation/creation. In the future, specialists will be able not only to apply ready-made software solutions in practice, but also to modify them in accordance with the characteristics of their own professional activities, and develop new digital services.

The obtained results can be used in the training of various specialists in the field of physical culture, sports and fitness.

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Subjective Images of Terrorism among Higher Education Students in the Russian Arctic

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Abstract

Young people constitute one of the risk groups most vulnerable to transmission of terrorist ideology and susceptible to entanglement in terrorist activities. This is related to social and psychological characteristics, social status, particular focus of destructive communities on the age group in question as well as increased riskogenics of social environment in general. Identifying subjective images of terrorism in higher education students is relevant since it is necessary to improve preventive actions taken by educational institutions alongside academic, nurturing and leisure activities.

The article provides an overview of research on the subject specified and the results of a sociological survey conducted in two largest higher education institutions in the Arctic region of the Russian Federation. The survey took place from November to December 2021 and involved 3966 bachelor's, specialist's and master's degree students majoring in the following fields: natural sciences, engineering and technical studies, information technologies (IT), social sciences and humanities, psychology and pedagogics, economics and management, medicine. The article indicates certain correlations between an academic major of responding higher education students and knowledge-based, context-dependent, competence-related and affective components constituting the image of terrorism as destructive ideology. The author concludes that higher education institutions shall improve the existing models of preventive actions by paying more attention to individual (group) approach.

Keywords: higher education, public opinion, terrorism, prevention of terrorism ideology.

1. Introduction

In 2017, UNESCO published a guideline for policy makers on the prevention of violent extremism through education (UNESCO, 2017). The guideline aptly notes that "...violent extremism knows no boundaries and affects every society. Young people are, however, most at risk.

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They are the main targets of recruitment strategies and fall victim to extremist violence» (UNESCO, 2017: 2). It is the potential of the education system that allows to develop young people's immunity to propaganda spread by extremists and terrorist groups (Baretto, 2005). In this regard, investment in education is a reliable long-term strategy in a fight against extremism and terrorism (Kristof, WuDunn, 2010), while making education the corner stone of counter-terrorism campaigns is able to ensure security worldwide (Lelo, 2011).

Increasing number of destructive trends operating outside the rules of law and making terrorism one of the ways to achieve the set goals and put pressure upon government institutions determines the importance of research into subjective images of terrorism among certain social groups. Understanding threats posed by any terrorist activities and general awareness of the terrorist problem are fundamental for the development of students' anti-terrorist attitude and their readiness for adequate action in emergency. The research into students' social images of terrorism is relevant due to the number of reasons.

First, young people as a group are most vulnerable to various destructive trends because of their sociopsychological characteristics and special social status (Kruzhkova i dr., 2016; Kurshev, 2022; Taylor, 1994). In this respect, essential aspects are financial insecurity, dependence on other people's opinion, uncompromising estimates and judgments, high online activity, misperception of destructive groups' objectives and mechanisms of manipulative influence, etc.

Secondly, destructive groups affiliated with terrorist activities have been relocating their operations into the virtual space, including social networks and computer games, which are used to recruit young people upholding radical views when it comes to politics, national, religious and social issues (Baykov, 2019; Muryukina, 2017; Stibli, 2010).

Thirdly, in order to put mass, group and individual measures of terrorist ideology prevention among young people into practice, education system as an institution of social engagement shall possess information on the degree of students' awareness of the terrorism problem, as well as on the level of their readiness to counter terrorist activities and ideology. The results of empirical research demonstrate insufficient students' awareness of the extremism and terrorism problem (Evtukh, Kotova, 2021; Valitova, 2020).

Social images of the terrorism problem among students have been the object of numerous studies across the globe since early 21st century. For instance, back in the 2000s a Japanese college conducted a survey among its bachelor's degree students regarding their opinion about the terrorist attacks against New York City and Washington, D.C. on September 11, 2001, and the Indian Parliament attack on December 13, 2001 (Alam, 2003). Although all studies on the subject matter in question are rather similar from the conceptual and methodological points of view, the following different categories lie at their core: images of terrorism, perception of terrorism, attitude towards terrorism, anti-terrorist stance, etc. A number of studies examine two or more interrelated phenomena (terrorism, extremism, interethnic communication, inter-religious conflicts, etc.) providing vast empirical evidence. Table 1 shows examples of studies devoted to the issues of students' social images of terrorism.

Table 1. Examples of research works on students' social images of terrorism

No.	Research site	Research scope	Research method(-s)	Research tools
1	The University of Jordan (Da'san, Alsawalqa, 2021)	400 students	Questionnaire-based survey	Original questionnaire
2	The institute of education and research Punjab University Lahore and University of education (Pakistan) (Ahmad et al., 2018)	267 students	- Questionnaire-based survey - Methods of statistical data processing	Original questionnaire (with the use of the Likert-type scale)
3	The Sun Yat-sen University; the Southern China University of Technology; the Guangzhou University of	500 students	Questionnaire-based survey (with additional in-depth interviews)	Original questionnaire (using the classical Almond and Verba's approach)

	Traditional Chinese Medicine and the Guangdong University of Foreign Studies (Shen, Liu, 2009)			
4	University of Nevada, Las Vegas (United States) (Mazmanyan, 2020)	9 students	Semi-structured interviewing	Original guide
5	A college in a Japanese city (Alam, 2003)	75 students	Questionnaire-based survey	Original questionnaire
6	Ivanovo State Power Engineering University (Russian Federation) (Lisova, Kryukova, 2021)	133 students	- Questionnaire-based survey - Free association method	Original questionnaire
7	Russian Presidential Academy of National Economy and Public Administration (Perm branch, Russian Federation) (Evtukh, Kotova, 2021)	170 (2019) and 288 (2021) respondents	Questionnaire-based survey	Original questionnaire
8	Higher education institutions in the Southern and the North Caucasian Federal Districts of the Russian Federation (Valitova, 2020)	4112 students	Questionnaire-based survey	Original questionnaire
9	Russian Open Academy of Transport at the Russian University of Transport Russian State University named after A.N. Kosygin (Russian Federation) (Kirillov, Kirillova, 2018)	212 graduates	Questionnaire-based survey	Original questionnaire
10	Smolensk State Medical University (Russian Federation) (Kiseleva i dr., 2016)	100 students	Questionnaire-based survey	Original questionnaire
11	Mari State University (Russian Federation) (Zimina i dr., 2016)	79 students	Questionnaire-based survey	Test questionnaire "Young people's attitude to terrorism"
12	Higher education institutions in Moscow and Ulan-Ude (Russian Federation) (Batueva, 2011)	190 students	- Questionnaire-based survey - Psychological assessment - Mathematical and statistical analysis	- Original questionnaire - Complex psychological assessment

The overview of studies devoted to subjective images of terrorism among students allows for the following conclusions:

1. The overwhelming majority of studies in question involved a relatively small sample of about 100-200 respondents, which means that the results obtained could basically apply only to a certain educational institution (research base), and that the empirical data is insufficient to be extrapolated to the regional or national level in order to carry out comprehensive statistical analysis.

2. Generalization of research findings demonstrates negative attitude of higher education students towards terrorism, yet the occurrence of responses bearing evidence of positive attitude indicates the necessity of identifying statistical correlations based upon other assessment parameters aiming to put together a holistic understanding of the existing social images of terrorism among students.

3. The studies analyzed are typically focused on knowledge-based and affective components constituting the images of terrorism among students. Researchers fail to pay proper attention to the issues regarding images of scope of the threat to the state and society, efficiency of measures taken by the authorities to counter the terrorist ideology, actions in the event of terror strikes, and effective solutions to stand against any destructive manifestations.

With regard to the above, the research presented is aimed at identification of dissimilarities in subjective images (knowledge-based, context-dependent, competence-related and affective components) of terrorism as a destructive phenomenon among higher education students in the Russian Arctic.

2. Materials and methods

From November 24 to December 16, 2021, a survey was conducted among higher education students of two largest universities in the Arctic region of the Russian Federation: Northern (Arctic) Federal University and Northern State Medical University. The study was carried out in the form of a survey with an original questionnaire as its basic tool.

The survey involved 4071 respondents (bachelor's, specialist's and master's degree students of all study years) with sample bias not exceeding 1.53 %. After sample rejection, 3966 questionnaires were accepted for analysis.

Questionnaire-based survey was held remotely via *LimeSurvey*, which is an online tool for anonymous surveys. The questionnaire included questions intended to determine the following:

a. Self-assessment of terrorism-related knowledge in students (knowledge-based component),

b. Images of scope of the threat to the state and society, efficiency of measures taken by the authorities to counter the terrorist ideology (context-dependent component),

c. Nature of feelings towards terrorists, degree of security in the face of terrorist attacks and level of confidence in the government authorities (affective component),

d. Level of awareness of actions to be taken in the event of terror strikes, ideas of most effective solutions to withstand terrorism (competence-related component).

After self-assessment of terrorism-related knowledge, all respondents were equipped with the definition of terrorism. Such approach derived from the necessity to minimize dissimilarities in the levels of awareness of the issue in question among the respondents. Thereupon, survey participants were to answer questions relating to the context-dependent, emotional, and competence-related aspects of terrorism images.

All questionnaires were divided with consideration for the specifics of the respondents' study programs, which resulted in the introduction of a variable called "Major". With regard to the specified indicator, seven respondent groups were distinguished: natural sciences, engineering and technical studies, information technologies (IT), social sciences and humanities, psychology and pedagogics, economics and management, medicine. The research findings were processed and analyzed via *SPSS.Statistic 17.0* computer program. In order to determine availability/non-availability of two-dimensional correlation between the variables, the author resorted to the "universal" non-parametric Pearson's chi-squared test ($\chi 2$) in order to derive contingency tables with ordinal and nominal variables. Applicability of Pearson's $\chi 2$ is proved by the fact that no more than 20% of the table cells have expected counts less than 5.

3. Results

78.8 % of respondents estimate their current knowledge of terrorism as good, 19.4 % rate it as superficial and 1.8 % demonstrate lack of any knowledge. It is worth mentioning that female respondents are more aware of the issue in question (79.4 %) than male respondents (77.6 %).

As far as statistical dependence is concerned, it exists when it comes to the respondents' majors ($p = 0.000$; $\chi 2 = 117.701$; $df = 12$). For instance, higher values of knowledge of terrorism were recorded among the students majoring in psychology and pedagogics (83.3%), social sciences and humanities (83 %), economics and management (82.7 %) (Table 2). Superficial knowledge of

the terrorism problem is more common among the students majoring in natural sciences, whereas medical students more often admit they lack any knowledge of terrorism (5.3 %).

Table 2. Distribution of responses to the question "Do you know what terrorism is?" with regard to the academic major, in % (N = 3966, p = 0.000)

Academic major of the respondent / Possible answers	natural sciences	engineering and technical studies	IT	social sciences and humanities	psychology and pedagogics	economics and management	medicine
Yes, I have good knowledge of it	73.5 %	75.2 %	78.8 %	**83.0 %**	**83.3 %**	**82.7 %**	76.4 %
Yes, I heard about it, but my knowledge is rather superficial	**25.8 %**	23.0 %	20.9 %	16.5 %	16.3 %	16.0 %	18.3 %
No, I don't.	0.7 %	1.8 %	0.3 %	0.5 %	0.4 %	1.3 %	**5.3 %**

Most of the respondents' feelings towards terrorists are fear (64 %), anger (45.3 %), desire to stand against (43.3 %), and weakness (34.1 %). Special emphasis shall be laid upon the existence of students expressing solidarity with terrorists (0.7 % of respondents), willing to join them (0.7 %), and sympathizing with them (0.8 %). The field of respondents' future professional activities with regard to this question is not quite representative: there is no dependence between most of the respondents' academic majors and the type of feelings they have towards terrorists ($p > 0.05$).

According to the majority of respondents (84.7 %), ideologies of terrorism and violent extremism pose a real threat to the Russian state and society. Students majoring in psychology and pedagogics (67 %) and medicine (65.5 %) express the most concerns about it. Students majoring in information technologies (IT), engineering and technical studies do not tend to express concerns about an existing threat of terrorism and extremism ideology spread in their responses (Table 3).

Table 3. Distribution of responses to the question "In your opinion, are terrorism and violent extremism ideologies a real threat to the Russian state and society at the moment?" with regard to the academic major, in % (N = 3966, p = 0.000)

Academic major of the respondent / Possible answers	natural sciences	engineering and technical studies	IT	social sciences and humanities	psychology and pedagogics	economics and management	medicine
Yes	62.2 %	58.1 %	55.7 %	64.4 %	**67.0 %**	62.1 %	**65.5 %**
No	9.2 %	**15.0 %**	**15.7 %**	11.3 %	8.3 %	13.2 %	8.7 %
Cannot say	28.6 %	26.9 %	28.5 %	24.4 %	24.7 %	24.7 %	25.7 %

There exists statistical dependence of this aspect from the respondents' academic major: $\chi 2$ value is 42.327 when df = 12, p = 0.000.

47.9 % of respondents demonstrate general sense of security in the face of terrorist attacks: 11.1 % feel secure, 36.8 % inclined towards the "more likely than not" option, 28 % chose "very unlikely", and 10.6 % responded "no". 13.5 % of students were undecided.

Students majoring in psychology and pedagogics showed the most concern about the terrorist threat in the previous question, which is why it makes sense that they feel less secure in the face of terrorist attacks (Table 4). It should be noted that 18.1 % of medical students were at a loss for an

answer to this question. With regard to this question, statistically relevant dependencies become apparent: $\chi 2$ value is 128.657 when df = 24, p = 0.000.

Table 4. Distribution of responses to the question "Do you feel secure in the face of terrorist attacks?" with regard to the academic major, in % (N = 3966, p = 0.000)

Possible answers \ Academic major of the respondent	natural sciences	engineering and technical studies	IT	social sciences and humanities	psychology and pedagogics	economics and management	medicine
Yes, I do	10.6 %	**16.9 %**	12.8 %	9.5 %	7.6 %	12.8 %	8.6 %
More likely than not	**45.6 %**	39 %	38.7 %	35.6 %	33.4 %	40.1 %	33.9 %
Very unlikely	21.9 %	21 %	25.2 %	33.6 %	**34.0 %**	24.2 %	30.2 %
No	10.6 %	9.6 %	10.5 %	11.5 %	**13.2 %**	8.4 %	9.2 %
Cannot say	11.3 %	13.5 %	12.8 %	9.8 %	11.8 %	14.5 %	**18.1 %**

As far as respondents' estimates regarding the level of awareness of their own actions to be taken in the event of terror strikes are concerned, 67 % of respondents claim they are well-aware: 14.6 % of students responded "very well-aware", whereas 52.4 % answered "rather well-aware than not". Medical students demonstrate higher values. 7.1 % of respondents majoring in natural sciences indicate that they do not know anything on the issue in question, while 32.5 % of IT-students admit poor awareness of actions to be taken in the event of terror strikes. It is also worth mentioning that 15.7 % of medical students were undecided about the answer to this question (Table 5).

Table 5. Distribution of responses to the question "How would you estimate your own level of awareness of actions to be taken in the event of terror strikes?" with regard to the academic major, in % (N = 3966, p = 0.000)

Possible answers \ Academic major of the respondent	natural sciences	engineering and technical studies	IT	social sciences and humanities	psychology and pedagogics	economics and management	medicine
I am very well-aware	13.1 %	14.8 %	10.8 %	9.3 %	11.5 %	13.2 %	**15.5 %**
I am rather well-aware than not	46.6 %	47.1 %	42.6 %	**50.2 %**	45.3 %	**48.9 %**	46.0 %
I am rather ill-informed than well-aware	25.4 %	20.9 %	**32.5 %**	28.0 %	30.2 %	24.7 %	19.4 %
I don't know anything about it	**7.1 %**	4.9 %	4.3 %	4.9 %	4.8 %	2.6 %	3.4 %
Cannot say	7.8 %	12.3 %	9.8 %	7.6 %	8.2 %	10.6 %	**15.7 %**

Statistically relevant dependencies between respondents' academic majors and their answers to the question "How would you estimate your own level of awareness of actions to be taken in the event of terror strikes?" are manifested in the test statistic $\chi 2$, which value is 95.632 when df = 24, p = 0.000.

10.3 % of respondents are absolutely confident that government authorities would take all necessary measures to protect citizens from terrorist attacks, whereas 38.2 % believe it is more likely than not, 25.4 % claim it is unlikely, 11.1 % are not at all confident in government protection, and 14.9 % are undecided.

Students majoring in engineering and technical studies along with those majoring in economics and management have quite a high regard for the actions of government authorities taken to ensure security from the acts of terrorism. This might be explained by the fact that students understand some specific features of anti-terrorist security system of facilities/territories, as well as the principles of developing anti-terrorist security passports for buildings, etc. Students majoring in psychology, pedagogics, social sciences and humanities are more critical in respect of assessing government actions designed to protect the citizens (Table 6). Statistically relevant dependencies between respondents' academic majors and their answers to this question are confirmed by $\chi 2$ values (98.344) when df = 24, p = 0.000.

Table 6. Distribution of responses to the question "Are you confident about the fact that government authorities would take all measures necessary to protect you from terrorist attacks?" with regard to the academic major, in % (N = 3966, p = 0.000)

Academic major of the respondent / Possible answers	natural sciences	engineering and technical studies	IT	social sciences and humanities	psychology and pedagogics	economics and management	medicine
I am absolutely confident	11.7 %	**14.2 %**	**13.1 %**	9.1 %	6.0 %	**12.3 %**	8.8 %
I believe it is more likely than not	**41 %**	**39.9 %**	37.7 %	36.4 %	35.4 %	**45.4 %**	37.8 %
I believe it is unlikely	20.5 %	21.5 %	27.2 %	**30.7 %**	**30.1 %**	19.8 %	24.3 %
I am not confident at all	10.6 %	9.7 %	**12.8 %**	**12.9 %**	**13.1 %**	8.4 %	10.0 %
Cannot say	**16.2 %**	14.7 %	9.2 %	10.9 %	**15.4 %**	14.1 %	19.1 %

According to 37.9 % of respondents, measures taken within the last 2-3 years did not have any pronounced impact on the pace of the terrorism ideology spread. 19.4 % of respondents chose the "very unlikely" option. However, almost half of the respondents (42.7 %) indicated a decrease in the spread of destructive ideas. The study identified statistically relevant differences in the distribution of responses with regard to the academic majors: $\chi 2$ value is 48.479 when df = 18, p = 0.000 (Table 7).

Table 7. Distribution of responses to the question "Do you think that measures taken by the Russian Federation government authorities during the last 2-3 years allowed for the decrease of the terrorism ideology spread?" with regard to the academic major, in % (N = 3966, p = 0.000)

Academic major of the respondent / Possible answers	natural sciences	engineering and technical studies	IT	social sciences and humanities	psychology and pedagogics	economics and management	medicine
Yes, I think so.	**12.7 %**	11.5 %	11.8 %	8 %	7.6 %	12.3 %	9.1 %
More likely than not	31.1 %	33.2 %	29.5 %	30.4 %	33.2 %	**38.3 %**	34 %
Very unlikely	20.1 %	15.5 %	19 %	**26 %**	21.9 %	13.2 %	18.8 %
No	36.0 %	**39.9 %**	39.7 %	35.6 %	37.3 %	36.1 %	38.1 %

Among the measures to be taken in order to improve efficiency of counter-terrorism efforts, respondents emphasize preventive activities: ensuring employment and enhancing people's life quality (56.8 %), developing federal and regional programs to protect citizens from terrorist threats (48.1 %). Outreach and awareness-raising work with the population ranks lower with the following distribution of responses: building public awareness of violence and terrorism unacceptability (41.5 %); disseminating information about counter-terrorism efforts of the federal and regional authorities on a centralized and regular basis (32.1 %); promoting explanatory work intended to raise people's vigilance in the present-day conditions (30.7 %); making people aware of the true purposes and objectives of religious doctrines (23.4%).

Every fourth respondent (24.6 %) had difficulty defining measures to produce the most tangible results in fighting the spread of terrorism and violent extremism ideologies, whereas 3.9 % of respondents indicated their ignorance of effective ways to counter terrorism. Increased control at the Russian border and at the border of the regions with intense terrorist activities in order to prevent trafficking of terrorist and extremist materials, as well as identification and blocking of websites having terrorist or extremist content across the country are among the most popular measures listed by the respondents as bringing about the most tangible results in fighting the spread of terrorism and violent extremism ideologies (Figure 1).

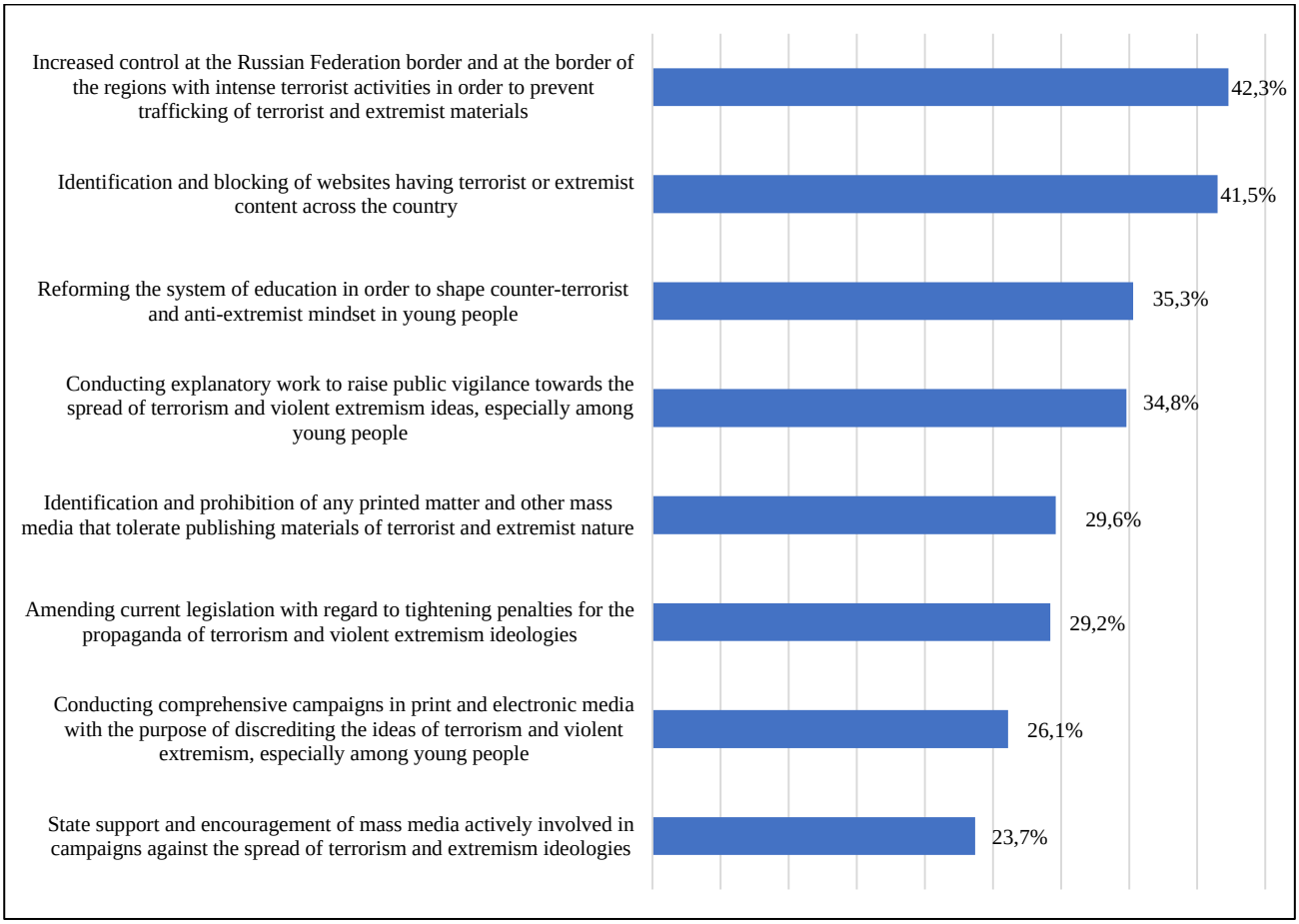

Fig. 1. Distribution of responses to the question "In your opinion, which of the measures given below would produce the most tangible effect in fighting the spread of terrorism and violent extremism ideologies?", in % (N = 3966)

4. Discussion

It is necessary to compare the empirical data obtained with the findings of similar studies devoted to students' social images of terrorism.

The results of research conducted by N.M. Da'san and R.O. Alsawalqa demonstrate that the majority of students consider terrorism an unforgivable crime, while terrorists appear as criminals, or separatist groups, willing to undermine stability and integrity of a certain state. Students indicate poverty and constrained material resources as the main reasons for terrorism (Da'san,

Alsawalqa, 2021). This aspect correlates with the findings of the survey carried out among the university students in the Russian Arctic, where more than a half of respondent (56.8 %) believe that ensuring employment and enhancing people's life quality are critical measures in counter-terrorism policy.

Conclusions drawn within the study by S. Ahmad et al. also show that poverty, other state's interference, wrong interpretation of Islam and social injustice are among the fundamental reasons for terrorism (Ahmad et al., 2018).

The results of a study conducted in Russia among the university students majoring in technical studies (Russian Open Academy of Transport at the Russian University of Transport – hereinafter referred to as ROAT) and humanities (Russian State University named after A.N. Kosygin – hereinafter referred to as RSU) are indicative of students' fragmented knowledge of the terrorism origins. Average scores of tests taken on the issues of counter-terrorism policies are rather low (3.05 at ROAT and 2.95 at RSU), but 89 % of students would like to inquire into the issues specified as they move along the training program. According to 45 % of respondents, terrorists are motivated by religious and ideological considerations. The results of a sociological survey from the Perm branch of the Russian Presidential Academy of National Economy and Public Administration showcase that terrorism is defined by university students as a threat to public morality and peace – 81.4 % (2021) and 70.49 % (2019) (Evtukh, Kotova, 2021). In accordance with the findings of the research presented in this paper, more than 80 % of respondents admit the existence of a real threat posed by the spread of terrorism and violent extremism ideologies.

Survey conducted among the students of the general medicine department at the Smolensk State Medical University (Russian Federation) demonstrates that 78 % of respondents define terrorism as an existing threat to the development of contemporary society, yet there were not any students denying the terrorist problem out 22 % that were undecided or not sure about their answer. For most of the students, terrorism associates with violence, fear and fanaticism. 49 % define terrorists as people suffering from mental disorders, while 37 % say terrorists commit their crimes knowingly, and 14 % were undecided. 64 % of respondents have fears that they or their relatives might fall victims to terrorists. Interestingly, the research did not reveal any dependence between students' religious views and their attitude towards terrorism. Basically, the research discovers poor students' awareness of the terrorism problem, whereby the existing images of terrorism are mostly shaped under the influence of mass media (Kiseleva i dr., 2016).

Of particular interest is the analysis of those empirical studies, which revealed students' attitude towards terrorism as an unlawful and socially destructive process and determined the structure of terrorism images, while at the same time clarifying the image of a terrorist from the students' point of view.

The results of research conducted by I.S. Zimina et al. (Zimina i dr., 2016) with the use of test questionnaires "Young people's attitude to terrorism" involving responses from 79 Mari State University (Russian Federation) students aged from 17 to 22 in order to look into the structure of future teachers' attitudes towards terrorism lead to the conclusions given below.

First, 95 % of respondents admit the existence of the terrorism problem and are aware of its dangers. 87 % of respondents note that they are not going to sympathize with terrorists under any circumstances, and 90 % of students consider terrorists criminals.

Secondly, students attribute to the image of a terrorist such traits as cruelty, self-interest, irascibility and instability. 74 % of respondents express concerns about the fact that they or their relatives might fall victims to terrorist attacks. Importantly, social distance plays a large part in developing the sense of threat. To be more specific, this refers to the geographic distance from the student's place of stay to the localities where serious terrorist attacks happened.

Thirdly, students believe that the main reason terrorists get involved in unlawful activities is their pursuit of feeling power over other people. Among other reasons are terrorists' commitment to a certain ideology and craving for material well-being. In general, researchers highlight structural irregularity with regard to students' social images of terrorism (Zimina i dr., 2016).

There were studies, which applied multiple interrelated methods. For example, a survey among 190 higher education students from Moscow and Ulan-Ude (Russian Federation) intended to determine sociopsychological and sociodemographic factors constituting an attitude towards terrorism showed that respondents' views on terrorism as a phenomenon is different from their view on certain types of terrorism. Subjective student images of terrorism, justice/injustice are related to peculiarities and modality of attitude towards terrorism, while also depending on the

respondent's region of residence. The image of a terrorist is ambiguous (the question implied an opportunity to choose several response options). For instance, 70.2 % define terrorists as murderers, criminals and kidnappers, 43.6 % claim they are religious fanatics, 16 % describe them as people defending themselves and their land, 14.4 % refer to them as revolutionists, and 13.3 % call them fighters for independence of their motherland. The image of a terrorist is associated with such feelings as anxiety and fear. The overwhelming majority (90 %) of respondents view terrorism as a negative or highly negative phenomenon. However, there are instances of positive (6 %) or neutral (4 %) attitude towards terrorism (Batueva, 2011).

As it appears from the studies outlined, each sample includes respondents indicating their neutral and positive attitudes towards terrorism. These individuals represent a potentially radical group most vulnerable to terrorist ideology, and this vulnerability increases with intensifying social, political, economic and ideological risk factors.

A pilot study among the students of university years 1-4 aged 18-22 held at the Ivanovo State Power Engineering University (Russian Federation) (N = 133) and designed to reveal the specifics of social images and attitudes concerning terrorism and extremism among the student youth in the region demonstrated that terrorism has a negative emotional coloring. Students' social images of terrorism are centered around the concepts of "death", "victims" and "destruction" (Lisova, Kryukova, 2021). The associative array stated above is an indication of fear pointed out by more than a half of respondents in the present research.

Particular attention shall be given to the results of a survey conducted in 2019 in the Southern and the North Caucasian Federal Districts of the Russian Federation involving a rather large multistage stratified sampling (N = 4112, respondent average age – 19). 79 % of respondents in the Southern Federal District and 76.9 % of respondents in the North Caucasian Federal District define terrorism as criminal acts of violence. The researchers conclude that the students possess an adequate yet incomplete understanding of the terrorism phenomenon being barely involved into the prevention efforts, which calls for improving the format of preventive activities.

Thus, the results obtained from the empirical study are quite consistent with the findings of similar surveys of mostly small samples (Ahmad et al., 2018; Batueva, 2011; Da'san, Alsawalqa, 2021; Kiseleva i dr., 2016; Lisova, Kryukova, 2021; Zimina i dr., 2016 et al.). However, the studies analyzed are rather limited due to the following:

a) Insufficient scope of research,

b) Reciting nature of research tools allowing to only observe general subjective images of terrorism among students,

c) Failure to distribute responses with regard to the academic majors of respondents.

Having regard to the last argument, the survey in question provides an important factor responsible for shaping students' subjective images of terrorism, which is their academic major. Statistically important links are distinguished in almost all respects examined: from students' general knowledge of terrorism to the issues of anti-terrorist security and assessing efficiency of measures taken by the authorities to counter terrorism ($p < 0.05$). While gender/age dependence is quite easy to understand and explain, dependence on the specifics of training, hence, future professional activities, requires consideration that is more thorough.

Does it imply that terrorist ideology prevention among students shall differ with regard to the academic major? There is no doubt about that, and this idea can be implemented as part of the so-called target-focused or group prevention model. Alongside this, the importance of general preventive practices shall not be reduced. First, such practices increase awareness of the terrorism problem allowing to decrease the number of students with only superficial knowledge of terrorism while at the same time facilitating development of their anti-terrorist attitude and their readiness for adequate actions in emergency. It is crucial to avoid the "second-hand terrorism" effect arising from excessive awareness and vigilance, which result in the feeling of insecurity and continuous anxiety in students (Comer, Kendall, 2007).

That said, how can one take academic and professional specifics of student training into account as part of the target-focused preventive practices?

First, it is necessary to amend university-wide academic courses with modules on counter-terrorism policies. In addition to the course/module on "Fundamentals of life and safety", it seems appropriate to include the counter-terrorist component into some other courses such as history, law, financial literacy, information technologies, philosophy, etc. This would increase awareness of the terrorism problem and allow for the development of a holistic image of terrorism and adequate

understanding of threats posed by terrorist activities among students. Basically, this would be the first step in overcoming fear of terrorists and developing a desire to stand against them. There could be a single course of lectures for all students, but it would be crucial to give practical classes with regard to the academic major. For instance, students majoring in engineering and technical studies would be interested in the issues of anti-terrorist security of buildings and structures, as well as of developing security passports for different facilities. Alternatively, students majoring in economics and management would look into the legal aspects of counter-terrorism policy.

Secondly, majors provide for preventive activities to be held in different formats with the focus on industry-specific components and regard to future professional activities. For example, IT-students would be interested in digital literacy olympiads where it could be possible and reasonable to introduce tasks dealing with prevention of the spread of illegal content on the web using modern information and communication technologies. Future lawyers would be excited to join public associations of legal volunteers in order to strengthen their competencies. Such activities could combine preventive elements with tasks useful for students' professional development.

Thirdly, it is advisable to organize sociopsychological work with students majoring in different fields in the form of workshops, seminars, games and other types of activities in order to encourage positive self-identities in general and transform the feelings of fear, anger and weakness towards terrorists into constructive counter-terrorist practices in particular. Students demonstrating a proactive approach to life and social activism could constitute a corps of volunteers to create and spread positive content, to search for and identify information contravening the current Russian legislation, to hold events and awareness-raising activities with students in order to inform them about relevant statutory provisions.

5. Conclusion

Thus, the research findings demonstrate that subjective images of terrorism among university students are relatively sporadic. Standing at around 80%, general awareness of the terrorism problem is rather high. At the same time, statistically important correlations with respondents' academic majors are observed in the majority of respects examined: from students' general knowledge of terrorism to the issues of anti-terrorist security and assessing efficiency of measures taken by the authorities to counter terrorism. This fact necessitates development and implementation of the target-focused model of preventive work with students majoring in different fields.

The data obtained correlates with the findings of similar studies. Particular concern is caused by the existence of respondents expressing readiness to join terrorists, as well as by ambiguous views upon the ways of increasing efficiency of counter-terrorism efforts. Taking all the aforesaid into consideration, it is recognized that further research requires broader set of tools, including psychodiagnostic evaluation and qualitative methods.

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Factors Associated with Creativity among STEM Learners: A Structural Equation Modeling Approach

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Abstract

As an effective way of cultivating technologically innovative talents, STEM education is gradually becoming the core driving force of innovative education. The key issues currently focused on by educators include analysing the factors influencing STEM innovation talents, exploring the training mechanism, and even promoting the educational revolution of talent cultivation. In this study, we adopted a structural equation modelling approach to explore class- and individual-level factors associated with creativity among STEM learners. Our study sample included 234 Chinese Junior High School students (Female = 51.71 %, Male = 48.29 %). Results indicated positive correlations between activity rules, personal characteristics, and division of tasks and creativity for STEM learners. Among them, activity rules had a stronger effect on personal characteristics compared to the division of tasks. The direct influence of the value of activity rules on personal characteristics was larger than that of creativity for STEM learners. Compared to personal characteristics, activity rules had a smaller effect value on creativity for STEM learners but a larger effect of total influence. The division of tasks was mediated by personal characteristics, which had a positive, albeit weak, effect on both personal characteristics and creativity for STEM learners. Findings from the study have implications for STEM education, policy, and research.

Keywords: creativity, junior high students, personal characteristics, STEM learners, structural equation modelling.

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1. Introduction

Whether in the past, present, or future, people will always face a wide variety of problems to solve in their lives, and the types and content of these problems are unpredictable. Creative problem-solving is considered an essential life and work skill for the 21st century (EU Commission Council, 2018; Williamson, 2001; World Bank, 2019). More and more people are beginning to recognise the vital value of creative cultivation (Organization for Economic..., 2019; Soh, 2017). Creativity is typically considered as the power or ability to create and produce, and the result can be abstract ideas or materialised products or solutions (Lubart, Sternberg, 1998; Paletz, Peng, 2008; Rhodes, 1961; Runco, 1999).

1.1. Creativity for science, technology, engineering and mathematics students

Science, technology, engineering and mathematics (STEM) education combines multi-disciplinary and inter-disciplinary experiences to gain knowledge and skills (Lamb et al., 2015). The integration of these multi-disciplinary approaches could enhance students' creativity in addressing real-life problems (Eroğlu, Bektaş, 2022; Nemiro et al., 2017; Shaughnessy, 2013). For example, Kuo et al. (2019) conducted an 18-week STEM Interdisciplinary Project-based Learning course for 45 college students. Results from their study showed a significant improvement in students' creativity. Additionally, after taking the course, students could think faster, develop more ideas and put more details into their thinking. Another study by Yalçın et al.(2021) among 39 children over eight weeks to verify the impact of preschool STEM educational activities on children's creativity showed a significant enhancement in creativity scores in the experimental group. However, the results indicated no significant difference in the control group. The meaningful relationship between STEM education and creativity makes more sense to explore the creativity of STEM students. Thus, STEM students can acquire the knowledge to integrate different subject systems to create new products (Henriksen, 2014). These findings also support the assertion that STEM education can foster the development of learner's creativity since it focuses on cultivating creativity (Harris, Bruin, 2018).

1.2. Critical influential factors for creativity

Human beings have never ceased to explore creativity and its associated factors to uncover the mysteries of creation and gain the power to transform the world. Weng et al. (2022) study showed that maker education based on realistic problems could build scaffolding for students' creativity. Students can perceive the support for creativity from the educational environment, which can be divided into cognitive, social, motivational and cultural scaffolding (Maksić, Jošić, 2021). It is a widely accepted belief that the availability of more choices could stimulate creativity, as it offers a greater range of potential solutions to problems (Sellier, Dahl, 2011). Likewise, unlimited freedom can boost people's desire to create more. However, in some specific disciplinary areas, for example, a creative writing course, clear limits are more conducive to innovation (Tromp, Baer, 2022). Correspondingly, Zhu et al. (2023) argued that there was a positive correlation between reappraisal and creativity. However, Mack et al. (2021) believed that abilities, personality traits, and skills were the key factors in nurturing natural science talents. Moreover, from the family perspective, parents' positive parenting style was more beneficial for children's creativity development (Dong et al., 2022).

Another important assertion worth noting is that the creativity of humans is not isolated but closely related to the social environment in which people find themselves. New ideas emerged from interactions with the environment and others (Glaveănu, 2010; Zhang et al., 2021). The creativity of humans is the result of the interaction between individuals and social culture, supported or limited by the external environment (Glaveănu, 2010). As mentioned earlier, most previous studies had focused on specific factors such as courses, external environment, family, and individuals, and few had comprehensively understood factors inside and outside the classroom. This research focused on the classroom and individual as a whole to study their joint interaction with creativity for STEM learners (CfSl).

1.3. Research model

From the Activity Theory Perspective, if STEM learning of students is viewed as an activity system, then factors at the class level include tools, rules, and labour division required for the activity. Individual factors are the learning characteristics of individual students. The goal of the activity is to cultivate innovative talents in STEM.

Activity tools

The COVID-19 pandemic has led to the rapid development of online teaching. For all its problems, it has crept into the educational horizon and reversed its position as a substitute for

offline instruction. The inclusion of network teaching has gradually changed the teaching centre from teaching to learning, from classroom learning to various learning modes, effectively making up for the shortage of high-quality resources and providing a new way for the development of high-quality basic education (Almahasees et al., 2021; Sulaiman, 2014). However, certain challenges are associated with online learning, such as low communication efficiency and limited interaction (Sjølie et al., 2022; Janssen, Kirschner, 2020). The interaction between teachers and students in offline classrooms provides an opportunity for face-to-face sharing of online experiments and results and enhances the feeling between teachers and students to make up for the lack of emotion in online learning (Kear, 2010; Kear et al., 2012). Both online and offline classrooms have their advantages and disadvantages. One of the issues addressed in this study is how these two types of classrooms integrate to give full play to their strengths. Therefore, this study uses both online and offline resources as instrumental indicators of STEM learning activities to investigate the impact of these two types of resources on STEM innovative talent. Specific activity tool indicators considered in the study included the following six elements: digital resources, virtual STEM programs, online communication, paper resources, real STEM programs, and face-to-face communication.

Activity rules

Problem-solving is a process of discovering the unknown. Important questions bothering problem-solving include: how do we nurture innovative talent, and what kind of learning inspires students to be innovative? To explore these issues, examining the rules guiding innovative, original problem-solving skills is important. Creativity comes from the exploration and perception of the unknown. Many scholars at home and abroad have provided general steps for problem-solving. A popular example is the four stages proposed by Basadur and his colleagues: problem generation, problem definition, program design and program implementation (Branford, Stein, 1993). Despite this, it is still unclear how the problem was solved and designed and what crucial thinking the problem solver went through in designing and implementing the solution.

According to Jäkel and Schreiber (2013), reflection can explain this question and point out that reflection is to rethink and reflect on the entire process of problem-solving to gain new experiences of problem-solving and systematically perceive the entire problem-solving approach. This approach will help individuals to solve the key problems and readjust the solutions (Jäkel, Schreiber, 2013). Furthermore, questioning has been recognised as an effective cognitive strategy during problem-solving design or introspection (Browne, Keeley, 2007). Of these, self-questioning has the least limited use. In addition, the relationship between the original cognitive structure of the problem solver and the problem is also the key information for the problem to be solved in problem-solving (Browne, Keeley, 2007; Wang, Chiew, 2010; Wu, Molnár, 2022). It can promote further understanding of the problem by the problem solver and then transfer knowledge through mining the correlation between knowledge and obtaining problem-solving solutions. Thus, this study sets the activity rules for STEM learning activities as three elements: reflection, self-questioning, and association mining.

Division of tasks

Division of tasks in a STEM project is the separation of roles in which community members' functions, attributes and responsibilities are described. Whether STEM education or innovative talent cultivation, both emphasise the student-centred teaching model and pay attention to the flexible, free and equal environment (Anjur, 2011), which shows an equal and independent relationship between students and teachers in cultivating STEM innovative talents. That is, the teacher takes on the work of teaching and instruction, and the student takes on the task of independent learning. Students are project/problem-oriented, independently choose the curriculum and content, and aim to complete projects or solve problems. Therefore, this study divides the task division of STEM learning activities into three types: student-independent learning, teacher instructional guidance, and learning partners.

Personal characteristics

Different solvers have different abilities when facing the same problem, which leads to different understandings of the difficulty of the problem. The greatest difference between experts and novices in solving problems lies in the way in which knowledge is stored and retrieved in their memories. Generally, experts tend to organise knowledge in a hierarchical and categorised way for easier memory storage; on the other hand, newcomers prefer to remember knowledge in pieces (Singh, 2009). Besides intelligence factors, non-intelligence factors are also important for creativity. Several studies have confirmed that individual learning motivation can promote students' creativity (Feist, 2006; Mack,2021; Makel, 2016). One of the typical elements of internal

motivation is learning interest, and one of the typical elements of external motivation is the motive to avoid failure. Therefore, personal characteristics such as previous cognitive structures, the motive to avoid failure and learning interests are selected to cultivate STEM innovative talents.

Activity objective

The goal of STEM learning activities is to foster creativity for STEM learners. As for the composition of individual creativity, although the original 1988 componential model was significantly modified, Amabile and Pratt still used the three main components of creativity in their 2016 paper. Including motivation to do creative work, skills in the task domain and creativity-relevant processes (Amabile, Pratt, 2016). Most scholars believe that creativity is the production of new ideas, products, and solutions. Hong and Song (2020) take idea creation and problem-solving as two sub-elements of creative behaviour. In addition to the dimensions of thought and ability, many studies have confirmed the key role of personality in creation, such as Conscientiousness (John, Srivastava, 1999; Amabile, 2018). However, there are also different views on this research. Ginns et al. (2014) believe that personality traits may be one of the key characteristics of creative talent. To this end, the study identified three components of STEM innovative talent: creative thinking, creative capacity, and creative personality.

1.4. The Present Study

This study aimed to extend the knowledge of CfSl by using the SEM to trace class- and individual-level antecedents' relationships with CfSl. More precisely, we examined the extent to which three class-level factors (i.e., activity tools, activity rules, and division of tasks) were associated with CfSl. We also investigated the extent to which individual-level factors (i.e., previous cognitive structure, the motive to avoid failure, learning interest) mediated the relationships between the class-level factors and CfSl. Three research questions guided this study, as follows:

1. To what extent are class-level factors (i.e., activity tools, activity rules, division of tasks) associated with CfSl?

2. To what extent are individual-level factors (i.e., previous cognitive structure, the motive to avoid failure, learning interest) associated with CfSl?

3. To what extent do individual teachers' factors mediate the relationship between school-level factors and CfSl?

This research hypothesises that all class-level factors are positively correlated with CfSl. Moreover, it has a positive effect on individual-level factors, which are positively correlated with CfSl. Hence, the hypothetical model was constructed, as shown in Figure 1.

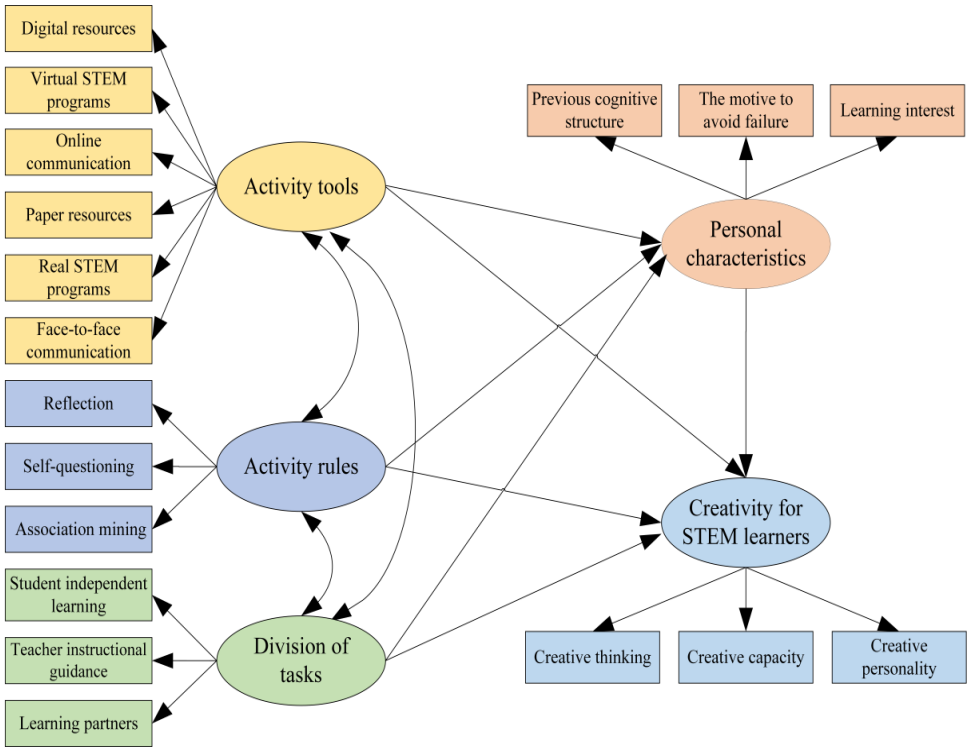

Fig. 1. Hypothesised model

2. Methods

2.1. Questionnaire Construction

A questionnaire was drafted based on the indicators from the above research model, and experts in STEM innovative talent cultivation were invited to evaluate the questionnaire indexes to ensure the rationality and effectiveness of the questionnaire structure. There were three experts: an associate professor at a university, an associate Researcher, and a research assistant at a scientific research institution. Some suggestions were given; for example, the presentation of the question was a bit abstract, which might be difficult for middle school students to understand. In addition, to increase the readability of the questionnaire, a junior high school teacher and three junior high school students were invited to read the questionnaire and make recommendations. Their suggestions included abstracting, looking tired, being unable to read, repeating words, etc.

After revision and adjustment of individual items, the final design of the questionnaire scale is shown in Table 1. What needs to be clarified is that the survey questionnaire was distributed in schools in China. The original questionnaire was presented in Chinese. It was translated into English here. Except for demographic information, all items in the survey were rated on a 5-point Likert scale, from 1 (strongly disagree) to 5 (strongly agree).

Table 1. Questionnaire outline of Factors affecting creativity for STEM students

Latent variable	Measurable variable	Strongly disagree Disagree Hard to define Agree Strongly agree
Personal characteristics	A1 previous cognitive structure	If I can organise the knowledge I have learned from different levels and disciplines, I can accurately extract the corresponding course knowledge in STEM classes.
	A2 The motive to avoid failure	The thought of the frustration of not being able to complete my STEM assignment made me dig even harder.
	A3 learning interest	If I am interested in STEM content, I will put more effort into my class.
Activity tools	B1digital resources	I like to read digital learning materials on my computer or mobile phone.
	B2 virtual STEM programs	I want STEM coursework to be done only on a computer, which is convenient and safe.
	B3 online communication	I prefer online communication with my teachers and classmates at home rather than at school.
	B4 paper resources	I would like to see the paper version of the research material.
	B5 real STEM programs	I like to complete STEM courses with real work in real life; it gives me a sense of accomplishment.
	B6 face-to-face communication	I prefer to go to school and communicate face-to-face with teachers and classmates rather than online.
Activity rules	C1 reflection	I believe that self-reflection can help me develop innovative ideas or thoughts to complete STEM projects.
	C2 self-questioning	Being able to ask my questions helped me think about and solve the problems I encountered in my STEM class.
	C3 association mining	If I can relate the STEM course to the knowledge I have learned, it will help me to do my homework in the STEM course better.
Division of tasks	D1 student independent learning	In STEM classes, I wish I could choose my own time, place, and pace of study.
	D2 teacher instructional guidance	I hope teachers can provide the necessary guidance and help in STEM courses.
	D3 learning partners	I want to collaborate and communicate with my classmates in the STEM class.
Creativity for STEM learners	E1 creative thinking	In STEM classes, I always develop innovative ways to solve problems.
	E2 creative capacity	In a STEM course, I know which material to look for or which parts of the curriculum knowledge to apply.
	E3 creative personality	I will work hard to finish my STEM assignments and will not flinch even when faced with difficulties.

2.2. Participants

The participants of this research were identified as Grade 8 students. The intensity sampling strategy was then applied to extract cases with high information density and intensity (Chen, 2000). As a type of purposive sampling, intensity sampling is useful in identifying cases rich with the information sought by the researcher (Sarfo et al., 2022). The sampling range was determined based on schools' recognition and implementation of STEM education. Then, within the sampling range, junior high schools A, B and C were randomly selected. Two classes of Grade 8 from each school were randomly selected as the survey subjects. These three schools are all key junior high schools in their respective regions, with a long history in STEM education. Participants' ages ranged from 13 to 15 years old, with a mean/standard deviation of 13.87±0.7284. All participants had fully equipped classrooms with STEM teaching and learning resources and teachers as part of their educational history. It was noted that they had previously achieved remarkable results in their STEM subjects. See Table 2 for details about participants' biodata.

Table 2. Participants' biodata (n = 234)

Variables	Categories	Frequency	Percentages
Gender	Female	121	51.71 %
	Male	113	48.29 %
School and Grade			
	School A -	38	16.24 %
	Grade 8	39	16.67 %
	School B -	39	16.67 %
	Grade 8	39	16.67 %
	School C -	40	17.09 %
	Grade 8	39	16.66 %

2.3. Data collection

In order to ensure the validity and reliability of the questionnaire, a small-scale test was conducted before the questionnaire was distributed. Test data showed good reliability and validity of the questionnaire scale, and formal questionnaires will continue to use this questionnaire. The questionnaire was sent to the class network group in the form of a questionnaire link (that is https://www.wjx.cn/), and the students completed it on the weekend. The questionnaire was distributed for two weeks, and 234 valid questionnaires were collected.

2.4. Data analysis

After cleaning the data of missing and invalid values, the normality of the data was tested. The absolute values of skewness of all variables are less than 1.74, and the absolute values of kurtosis of all variables are less than 3.28, which meets the recommendation. It indicates that the hypothesis of normal distribution is not seriously violated, and the distribution is moderately normal (Curran et al., 1996). The mean and standard deviation of each variable were then calculated by SPSS 25.0, and the reliability and validity were calculated. Finally, taking class-level factors as the independent variable, CfSl as the dependent variable and personal characteristics as the intermediate variable, the structural equation model was built and analysed with AMOS 28.0.

3. Results

3.1. Descriptive statistics

The descriptive statistics of each latent variable can be seen in Table 2. Among the three class-level factors, the division of tasks scored the highest (M = 4.47, SD = 0.63), followed by activity rules (M = 4.39, SD = 0.71) and activity tools (M = 3.90, SD = 0.70). It suggests that the division of tasks is more important in STEM learning, followed by activity rules and tools. The average scores for personal characteristics and CfSL were above 4.20. The correlation between variables ranges from 0.58 to 0.78.

3.2. Reliability and validity of the instrument

The internal reliability of the data was measured using CITC and Cronbach's alpha. The CITC is used to analyse the Corrected Item-Total Correlation (CITC). Generally, CITC values greater than 0.35 are considered acceptable, with values greater than 0.4 being preferable. Cronbach's alpha coefficient greater than 0.7 is acceptable. The results are shown in Table 3.

Table 2. Descriptive statistics and correlations between the latent variables (n = 234)

Variables	1	2	3	4	5
1. Personal characteristics	1				
2. Activity tools	.65**	1			
3. Activity rules	.76**	.59**	1		
4. Division of tasks	.71**	.58**	.75**	1	
5. Creativity for STEM learners	.76**	.68**	.78**	.69**	1
Mean, SD					
Mean	4.40	3.90	4.39	4.47	4.21
SD	0.68	0.70	0.71	0.63	0.75

Note: **p < .01.

Table 3. The results of the original reliability test

Latent variable	**Measurable variable**	**CITC**	**Cronbach's Alpha after Item Deletion**	**Cronbach's α**
Personal characteristics	A1 previous cognitive structure	0.782	0.773	0.864
	A2 the motive to avoid failure	0.791	0.781	
	A3 learning interest	0.699	0.859	
Activity tools	B1 digital resources	0.546	0.682	0.740
	B2 virtual STEM programs	0.632	0.652	
	B3 online communication	0.565	0.679	
	B4 paper resources	0.450	0.713	
	B5 real STEM programs	0.497	0.703	
	B6 face-to-face communication	0.201	0.763	
Activity rules	C1 reflection	0.859	0.893	0.911
	C2 self-questioning	0.890	0.829	
	C3 association mining	0.814	0.814	
Division of tasks	D1 student independent learning	0.649	0.815	0.835
	D2 teacher instructional guidance	0.748	0.737	
	D3 learning partners	0.722	0.759	
Creativity for STEM learners	E1 creative thinking	0.781	0.841	0.887
	E2 creative capacity	0.799	0.824	
	E3 creative personality	0.763	0.854	

Except for B6 face-to-face communication, it can be seen that the CITC values of other indicators are all above 0.4, and Cronbach's α value after deleting this item is smaller than the α value of the original variable. The Cronbach's α of all latent variables were all above 0.74.

The results of the reliability with the B6 removed are shown in Table 4.

Table 4. The results of the reliability test – after B6 is deleted

Latent variable	**Measurable variable**	**CITC**	**Cronbach's Alpha after Item Deletion**	**Cronbach's α**
Activity tools	B1 digital resources	0.562	0.710	0.763
	B2 virtual STEM	0.673	0.664	

	programs		
	B3 online communication	0.645	0.679
	B4 paper resources	0.397	0.762
	B5 real STEM programs	0.420	0.757

The results after further removing B4 and B5 were shown in Tables 5 and 6, respectively. All items of the scale met the requirements and had high reliability.

Table 5. The results of reliability test – after B6 and B4 are deleted

Latent variable	Measurable variable	CITC	Cronbach's Alpha after Item Deletion	Cronbach's α
Activity tools	B1 digital resources	0.612	0.680	0.762
	B2 virtual STEM programs	0.691	0.629	
	B3 online communication	0.645	0.661	
	B5 real STEM programs	0.331	0.805	

Furthermore, B4, B5 and B6 have too low CITC values, indicating a weak correlation between them and the other indicators. Therefore, these three indicators were removed, and the remaining indicators were renamed as online resources.

Table 6. The results of reliability test – after B6, B4, and B5 are deleted

Latent variable	Measurable variable	CITC	Cronbach's Alpha after Item Deletion	Cronbach's α
Activity tools	B1 digital resources	0.617	0.772	0.805
	B2 virtual STEM programs	0.709	0.673	
	B3 online communication	0.643	0.749	

Principal component analysis was used for confirmatory factor analysis. Factor rotation mode is the varimax method. Kaiser has given common measures of the Kaiser-Meyer-Olkin (KMO) Test for Sampling Adequacy: above 0.9 is very suitable, 0.8 to 0.9 is very suitable, 0.7 to 0.8 is suitable, 0.6 to 0.7 is generally adequate, 0.5 to 0.6 is not very suitable, and below 0.5 is unacceptable (Kaiser, 1974).

The extraction value of commonality shows the extent to which the extracted factor is representative of the original variable. Generally, it is accepted if the interpretability reaches 50 %. The cumulative contribution rate refers to the proportion of variation caused by all factors in the total variation, that is, the total influence of common factors on dependent variables. Generally believed, a cumulative contribution rate of 60 % is acceptable.

The KMO and Bartlett's test were performed on each variable; the results are shown in Table 7. The KMO values ranged from 0.7 to 0.8, indicating that it was suitable for factor analysis. In the principal component analysis, as shown in Table 7, the extraction value of communality of all variables was above 68 %, most of which were around 80 %. It can be considered that the extracted factors have a certain explanatory ability for each measurable variable. In the total variance explained, factors were extracted according to the criterion that the initial eigenvalue was above 1. If the cumulative contribution rate of the extracted factor reached more than 72 %,

it indicates that the factor had a better explanatory ability for the variables. Thus, these findings indicated that each variable had good structural validity, and the result of factor analysis is ideal.

Table 7. The results of factor analysis

Latent variable	KMO and Bartlett's Tests				Communalities			Total Variance Explained						
		Bartlett's Test of Sphericity						Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	KMO	Appro. Chi-Square	df	Sig.		Initial	Extraction		Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
Personal characteristics	.725	358.354	3	.000	A1	1.000	.818	1	2.386	79.534	79.534	2.386	79.534	79.534
					A2	1.000	.830	2	.380	12.661	92.195			
					A3	1.000	.738	3	.234	7.805	100.000			
online resources	.699	232.938	3	.000	B1	1.000	.683	1	2.167	72.244	72.244	2.167	72.244	72.244
					B2	1.000	.777	2	.486	16.211	88.455			
					B3	1.000	.708	3	.346	11.545	100.000			
Activity rules	.737	586.179	3	.000	C1	1.000	.879	1	2.628	87.584	87.584	2.628	87.584	87.584
					C2	1.000	.916	2	.254	8.455	96.039			
					C3	1.000	.832	3	.119	3.961	100			
Division of tasks	.714	292.628	3	.000	D1	1.000	.782	1	2.281	76.045	76.045	2.281	76.045	76.045
					D2	1.000	.799	2	.434	14.451	90.496			
					D3	1.000	.701	3	.285	9.504	100			
Creativity for STEM learners	.746	392.239	3	.000	E1	1.000	.817	1	2.451	81.685	81.685	2.451	81.685	81.685
					E2	1.000	.834	2	0.301	10.032	91.716			
					E3	1.000	.800	3	0.249	8.284	100			

3.3. SEM results

The Maximum Likelihood method was used to fit the model, and the standardised estimates are shown in Figure 2. The model gave good fits: CFI = 0.957, TLI = 0.943, RMSEA = 0.079 and SRMR = 0.0439, but some variables had low load and path coefficients. According to the judgment criteria of "factor load at least 0.60, standardised path at least 0.30", the variables and paths that do not meet the standards would be deleted.

After correction, the result of the modified fit is shown in Figure 3. The model fitted well: CFI = 0.958, TLI = 0.943, RMSEA = 0.094, SRMR = 0.042. The modified variable load coefficients and path coefficients satisfied the established requirements. Activity rules had significant positive effects on personal characteristics ($\beta = 0.50$, $p < 0.001$) and CfSl ($\beta = 0.44$, $p < 0.001$). Division of tasks had a significant positive effect on personal characteristics ($\beta = 0.39$, $p < 0.001$) but had no direct effect on CfSl. Compared to the division of tasks, activity rules had a larger impact on personal characteristics. Personal characteristics significantly positively affected CfSl ($\beta = 0.51$, $p<0.001$). Online resources had a weak positive effect on Personal characteristics ($\beta = 0.20$, $p < 0.001$) and CfSl($\beta = 0.12$, $p < 0.001$). Division of tasks had a weak direct effect on CfSl ($\beta = 0.11$, $p < 0.001$).

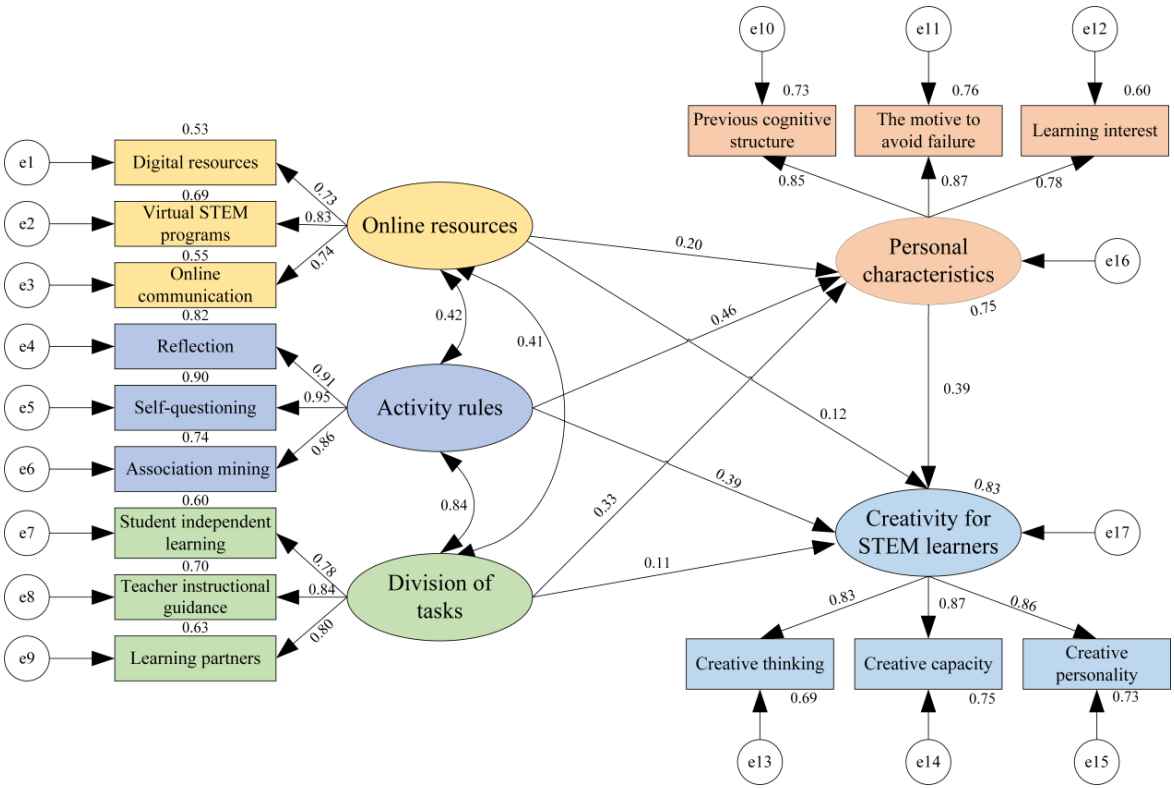

Fig. 2. The graph of normalised path coefficient – before model modification

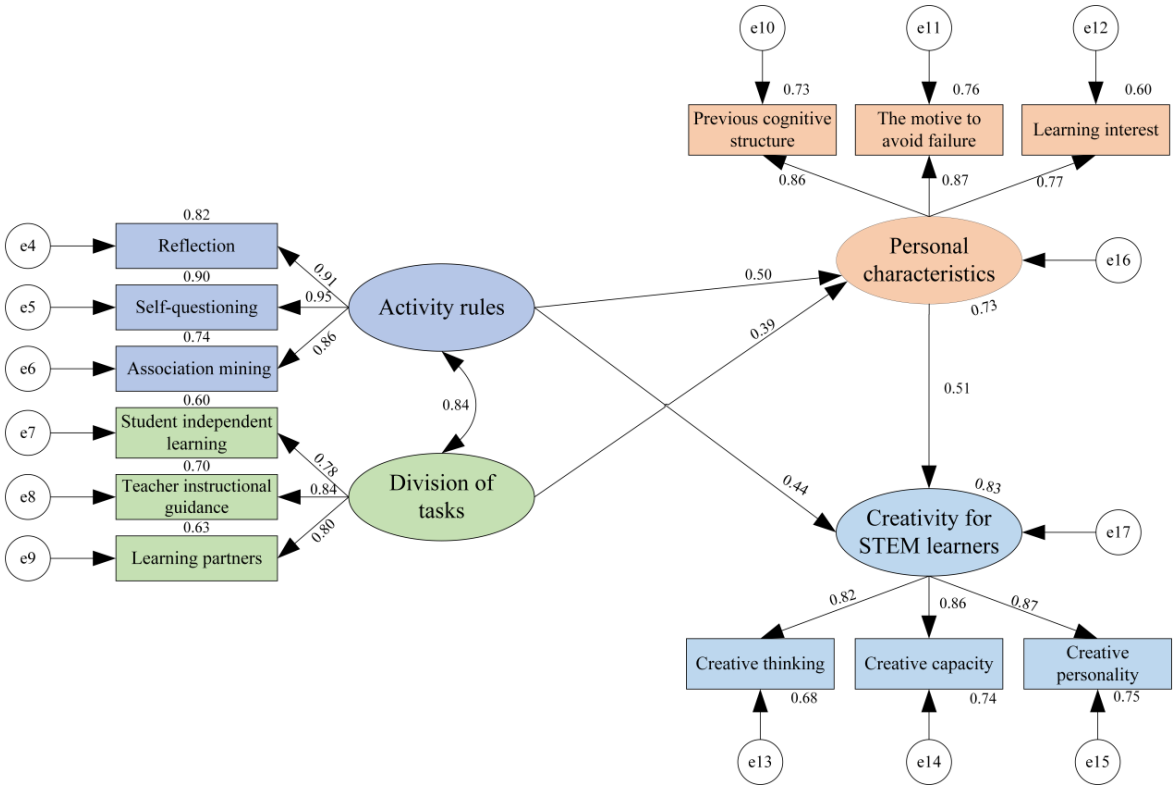

Fig. 3. The graph of normalised path coefficient – after model modification

4. Discussion

This research examined the relationships between class-level, individual-level factors, and CfSl. Found that activity rules had a stronger effect on personal characteristics compared to the division of tasks. The direct influence of the value of activity rules on personal characteristics is larger than that of CfSl. The division of tasks was mediated by personal characteristics, which indirectly positively affect CfSl, but only weakly on both personal characteristics and CfSl.

4.1. Relationships between class environments and personal characteristics

Both division of tasks and activity rules were positively correlated with personal characteristics. Among them, compared to the division of tasks (0.39), activity rules (0.50) had a greater impact on personal characteristics, as shown in Table 8.

Some studies have proved that reflection could promote students' reading, expression, analysis and other abilities (Darmawansah et al., 2022; Oo, Habók, 2022; Hsu et al., 2022). Along the way, individual characteristics of students, such as cognitive structure and learning interests, will inevitably change. Polya (1945) believed that exploring and analysing relationships between concepts could facilitate the solution of mathematical problems. The practice research of Yuriev and his colleagues also showed that students repeatedly used relationships between concepts and restructuring the problem when solving chemistry problems (Yuriev et al., 2017). Schwartz (2016) believed that children's curiosity occurred in the interval of interaction with others, and asking questions was a way of high-quality interaction between teachers and students. Questioning itself is a cognitive activity. How to raise better questions and create a zone of proximal development based on students' existing cognition was worth continuous exploration by teachers and students (Salmon et al., 2021).

The above results were consistent with the conclusions of the present study. There seems to be little research examining the value differences between cultures and divisions of labour in shaping students. This study found that compared to the division of tasks (0.39), activity rules (0.50) had a greater effect on personal characteristics, as shown in Table 8. It can be argued that the learning culture or rules created by learning cognitive activities better shape the quality characteristics of individual students compared to the function of different roles in learning. As shown in Table 8, of the three sub-elements of personal characteristics, the activity rules and the division of tasks had the greatest impact on the motive to avoid failure; second, the previous cognitive structure; and finally, the learning interest. It can be argued that emotional motivation is the most easily influenced by external circumstances, which then mobilise students to construct meaningful learning, change cognitive structures, and finally, slowly change their interest in learning a particular course.

4.2. Relationships between class environments, personal characteristics, and CfSl

Both personal characteristics and activity rules were positively correlated with CfSl. Among them, compared to personal characteristics (0.51), activity rules (0.44) had a smaller effect value on CfSl but a larger effect of total influence (the total effect value of activity rules is 0.699; The activity rule has a total effect value of 0.699; the total effect value of personal characteristics is 0.507), as shown in Table 8. As the mediating variable of activity rules and CfSl, the mediating effect size of personal characteristics was 36.48 % (indirect effect/total effect) *100 %. It showed that the direct effect of the activity rules on CfSl had a larger value than the indirect effect. The above indicated that the cultural atmosphere of learning rules was more strongly related to CfSl than the learners themselves.

Hao et al. (2016) used electroencephalography to explore the neural correlates of idea generation and reflective assessment. The results showed that participants' ideas after the reflection task were more original than those they had previously generated. They suggested that reflective evaluation may induce a high degree of internal attention or top-down activity, thus promoting effective retrieval and integration of internal memory representations and saving intellectual energy to generate new ideas. Studies proved that possible thinking could drive creativity (Chappell et al., 2008; Craft et al., 2012; Cremin et al., 2013). Questioning, as one of the characteristic features of possibility thinking, is the process of completing inquiry by continually asking and answering questions, creating conditions and opportunities for creation. In this study, a similar conclusion was obtained by means of a structural equation model. The difference was that, in this study, the cultural atmosphere of learning rules was found to be more strongly correlated with CfSl compared to individual characteristics. Division of tasks had only an indirect effect on CfSl, with an effect value of 0.196, which was low.

Moreover, of the three sub-elements of CfSl, whether personal characteristics, activity rules or division of tasks, it had the greatest influence on the cultivation of creative personality, followed by creative capacity and creative thinking, as shown in Table 8. It showed that of the three characteristics of CfSl, creative personality was the easiest to cultivate, creative capacity could be developed slowly, and only creative thinking required more time and energy. At the same time, it

also showed that creative thinking was probably the most important of the three characteristics of innovative talent.

Table 8. Standardised Total Effects, Standardised Direct Effects, and Standardised Indirect Effects

Variables	Standardised Total Effects				Standardised Direct Effects				Standardised Indirect Effects			
	DOT	Activity rules	PC	CfSl	DOT	Activity rules	PC	CfSl	DOT	Activity rules	PC	CfSl
Personal characteristics	.386	.503	.000	.000	.386	.503	.000	.000	.000	.000	.000	.000
CfSl	.196	.699	.507	.000	.000	.444	.507	.000	.196	.255	.000	.000
Learning interest	.299	.389	.775	.000	.000	.000	.775	.000	.299	.389	.000	.000
The motive to avoid failure	.337	.439	.873	.000	.000	.000	.873	.000	.337	.439	.000	.000
Previous cognitive structure	.330	.430	.856	.000	.000	.000	.856	.000	.330	.430	.000	.000
creative personality	.170	.606	.440	.867	.000	.000	.000	.867	.170	.606	.440	.000
creative capacity	.168	.600	.436	.859	.000	.000	.000	.859	.168	.600	.436	.000
creative thinking	.161	.576	.418	.824	.000	.000	.000	.824	.161	.576	.418	.000
Student independent learning	.776	.000	.000	.000	.776	.000	.000	.000	.000	.000	.000	.000
Teacher instructional guidance	.836	.000	.000	.000	.836	.000	.000	.000	.000	.000	.000	.000
Learning partners	.796	.000	.000	.000	.796	.000	.000	.000	.000	.000	.000	.000
Association mining	.000	.860	.000	.000	.000	.860	.000	.000	.000	.000	.000	.000
Self-questioning	.000	.950	.000	.000	.000	.950	.000	.000	.000	.000	.000	.000
Reflection	.000	.906	.000	.000	.000	.906	.000	.000	.000	.000	.000	.000

Notes: PC = Personal characteristics; DOT = Division of tasks

5. Conclusion and implications

In the present study, SEM was used to explore the mechanism of influence of classroom and individual-level factors on CfSl. The results revealed conclusions similar to existing studies, but also extended them. This study found that of all the environmental-level factors, activity rules had the greatest impact on CfSl, even more so than personal characteristcis. This highlighted the key value of the learning rules culture in innovative learning. In addition, the study found that among personal characteristics, emotional motivation, such as the motivation to avoid failure, was most susceptible to external environment, which then mobilised students to construct meaningful learning, altered cognitive structure, and finally slowly changed their interest in learning a course. In the cultivation of innovative talent, creative personality is the easiest to cultivate, creative capacity can be developed slowly, and only creative thinking requires more time and effort.

5.1. Activity rules had the greatest influence on the cultivation of CfSl

As seen from the findings, activity rules had a stronger effect on creativity generation compared to personal characteristics. The relationship between personal characteristics and activity rules can be analogous to the relationship between self and the outside world or between humans and nature, indicating that the occurrence and operation of things should follow the natural law and combine their own characteristics. At the same time, it also brings some enlightenment to teaching.

5.2. There was a split between online and offline resources

The confirmatory factor analysis and reliability calculation results in this study decomposed the online and offline learning resources into two factors, namely online and offline resources,

indicating that these two factors were independent and uncorrelated. That is, there was a strong separation between online and offline resources. The reason may be attributed to the natural "relative" characteristics of the two factors, which were similar to "reality and network", and also caused the "inherent" attribute of this separation problem. This issue posed a great challenge for integrating online and offline teaching. Since there is a strong separation between different types of resources, it is necessary to turn our attention to content and methods for the integration of online and offline teaching. The continuity and complementarity of online and offline teaching content should be ensured, and the coherence and appropriateness of the integrated approach should be ensured to eliminate as much as possible the sense of separation caused by the use of online and offline resources together.

5.3. The motive to avoid failure can stimulate the learners' desire for innovation

Of the three sub-elements of the learner, the standardised effect value of learners' motivation to avoid failure was the largest, indicating that this factor had the greatest impact on the learner's creativity, the second was the previous cognitive structure, and the last was the learning interest. It is well known that the motive to avoid failure is the motivation to avoid failure, punishment, and other external factors, and it belongs to the class of external motives. Learning interest is the motivation arising from the learner's interest in the thing itself, which belongs to the internal motives. It can be argued that external motivation better stimulates the learner's desire to innovate compared to internal motivation. Modern psychological research also showed that the persistence of internal motivation was stronger than that of external motivation, which can only be sustained on the premise of obtaining some reward or avoiding some kind of punishment (Balamoorthy, Chandra, 2023; Diwakar et al., 2023; Liu, 2020). This study hypothesised that external incentives were more stimulating in the short term but less persistent. More research is needed to confirm this. Of course, motivation is also influenced by the learner's age, subject, period of study, and many other factors. Based on these assumptions, this study suggests that in teaching, students' learning and creative aspirations may be more stimulated if teachers can give certain rewards and punishments compared to the learner's interests and preferences.

5.4. Innovative thinking maybe a core trait of CfSl

The study's findings showed that activity rules and personal characteristics had the greatest influence on the development of the creative personality, followed by the creative faculty and creative thinking. Thus, this study presents the following three perspectives:

a. Creative personality was the key characteristic of CfSl. Personality characteristics, just like human habits, can be developed through acquired perseverance, a quantitative and fundamental change in the cultivation of innovative talent.

b. Creative capacity was the characteristic of CfSl, which can be obtained after continuous training day after day. In other words, if a person has a strong creative capacity, it indicates that he has a durable and stable trait of innovation, but this trait may be temporary and one-off. Only changes in thinking are durable and long-lasting, resulting from qualitative changes followed by quantitative ones.

c. Creative thinking is the core trait of CfSl, which is the most difficult to develop. It may also be the most precious trait of STEM innovative talents, which is not easy to copy and imitate. The creative capacity of a person with creative thinking should be stable and lasting, able to output innovative results and show stable creative thinking continuously. Objective reasons such as project difficulty will not affect the thinking judgment (Azaryahu et al., 2023). It takes a long time to develop. Some implications for STEM innovation talent cultivation: the persistence of a learning character is the foundation of innovation, and only sufficient effort and knowledge can be the soil for innovation.

6. Limitations

The limitations of the present study suggest directions for future research. First of all, the questionnaire scale of this study was self-developed, and its scientificity and validity required more exploration. Secondly, this study focused on the influence of classroom and individual levels on CfSl. However, this study did not include parents and other factors (Dong et al., 2022; Li et al., 2022). Besides, the data in this study were all from questionnaires, so if supplemented by interviews, we might have a deeper understanding of the conclusions of the study. Finally, due to the academic ability of the authors, an in-depth description of the internal psychological mechanisms among the various variables was not detailed enough, which was not conducive to the

understanding of the cultivation mechanism of CfSl. Therefore, future studies need to re-test the relationships between the studied variables using validated scales to confirm whether the conclusions of this study were available. Additional supporting material, such as interviews with teachers and students, should be collected to test the findings. In addition, the internal psychological logic of the inter-variable influence mechanism needed to be explored in detail to obtain more extended information about CfSl.

7. Ethics statement

All students participating in the study were informed of the purpose of the survey and the data collection process and consented to participate.

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10. Competing interests

The authors declare no competing interests.

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The History of Education

The System of Public Education in Don Host Oblast (1790–1917). Part 1

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Abstract

This study explores the system of public education in Don Host Oblast in the period 1790–1917. The present part of the study focuses on the period 1790–1900.

The principal sources for the study are periodicals associated with Don Host Oblast, including *Transactions of the Don Host Statistics Committee*, *Memorandum Books for Don Host Oblast*, *Don Host Oblast Directory*, and the reference periodical *Don Oblast and the North Caucasus*, as well as the yearly *Most Faithful Report of the Chief Procurator of the Holy Synod*.

The study's findings revealed that during the period 1790–1900 Don Host Oblast witnessed brisk development in its public education sector. In that time, serious work in this area in the region was carried out by the Ministry of Public Education and the Holy Synod. By 1900, the Don region had an entire network of schools, which included 15 secondary, as many lower, and more than 1,500 primary educational institutions. For a long time, the region experienced a significant gender imbalance (girls accounting for 10–15 % of the total number of students). In the late 19th century, this imbalance began to decrease, with the number of girls reaching 39 % in 1900 – a definite success in terms of making education equally accessible for both genders in the region.

Keywords: Don Host Oblast, Russian Empire, system of public education, schools, gymnasiums, period 1790–1917.

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1. Introduction

During the prerevolutionary period, Don Host Oblast was part of the Kharkov Educational District, which also included Voronezh, Kursk, Penza, Tambov, and Kharkov Governorates. As at 1897, Don Host Oblast had a population of more than 2.5 million people, with 265,000 of those residing in cities and the rest – in the countryside (Naselenie..., 1898: 27). The region was dominated by Orthodox Christians. This part of the work focuses on the system of public education in Don Host Oblast in 1790–1900.

2. Materials and methods

The principal sources for the study are periodicals associated with Don Host Oblast, including *Transactions of the Don Host Statistics Committee*, *Memorandum Books for Don Host Oblast*, *Don Host Oblast Directory*, and the reference periodical *Don Oblast and the North Caucasus*, as well as the yearly *Most Faithful Report of the Chief Procurator of the Holy Synod*. Of note is the fact that the above-mentioned periodicals provided statistics on public education in the region only occasionally. On top of that, the information available at the time also included data on military (e.g., a cadet corps or a junker school) and ecclesiastical educational institutions (e.g., an ecclesiastical seminary or an ecclesiastical female school). This prompted the use in the present study of the content analysis method. The use of this method helped extract from a vast body of statistical information only the data on the region's educational institutions under the purview of the Ministry of Public Education. In addition, use was made of the retrospective method – in order to examine the development of the system of public education in Don Host Oblast in historical sequence.

3. Discussion

The historiography on the subject may be divided into two thematic groups: 1) publications on the history of the system of public education in Don Host Oblast; 2) publications on the history of the system of public education in the Kharkov Educational District, which Don Host Oblast was part of.

The first group includes the work by M.A. Kolomeytseva, which explores the making and development of school education in Don Host Oblast during the post-reform period (Kolomeitseva, 2015), the one by M.A. Kolomeytseva and A.N. Komandzhayev, which looks at similar processes in the second half of the 19th century (Kolomeitseva, Komandzhaev, 2014), the one by A.Yu. Peretyat'ko and T.E. Zul'fugarzade, which examines a draft reform of education in the Don region (Peretyatko, Zulfugarzade, 2017), the one by I.D. Palkina, which covers music education in the region (Palkina, 2014), and the one by A.A. Solov'yev and his colleagues, which addresses the literary education of students in Don Host Oblast (Solovyev et al., 2020).

The second group includes the works by A.A. Cherkasov and his colleagues, which explore the development of the system of public education in Voronezh Governorate (Cherkasov et al., 2020; Cherkasov et al., 2020a), the ones by G. Rajović and his colleagues, which look at similar processes in Tambov (Rajović et al., 2023; Rajović et al., 2023a) and Kursk Governorates (Rajović et al., 2023b; Rajović et al., 2023c), and the ones by A.M. Mamadaliyev and his colleagues, which cover the system of public education in Penza Governorate (Mamadaliev et al., 2022; Mamadaliev et al., 2022a; Mamadaliev et al., 2022b).

4. Results

Educational institutions under the purview of the Ministry of Public Education

The first educational institution in Don Host Oblast, a main public school, was established in the city of Cherkassk in 1790. In 1805, the school was moved to the city of Novocherkassk and transformed into Novocherkassk Male Gymnasium (Robush, 1867: 119).

Starting in 1820, public schools were opened in various stanitsas across the region. By 1836, Don Host Oblast had 13 schools – 8 primary (two-grade) and 5 parish. The schools were maintained through the stanitsas' own funds (Robush, 1867: 119).

During the period 1836–1839, the region had 1 male gymnasium, 7 district schools, and 19 parish schools.

In 1844, the region became home to another parish school and a two-grade Kalmyk school. This combined total of 29 educational institutions remained unchanged until 1859. Of note is the fact that education in the region was mainly for boys, with girls having to go about it on their own – they could either enlist the services of special tutors specializing in instruction in the reading of ecclesiastical books or enroll in a parish school that admitted females (Robush, 1867: 120).

In 1859, the appointed ataman of the Don Host, Adjutant General M.G. Khomutov, proposed setting up in Novocherkassk a female gymnasium and second- and third-class female schools and opening more male parish schools.

Table 1. Student Body in Don Host Oblast in 1805–1860 (Robush, 1867: 119-120)

Year	Number of students in educational institutions			
	Gymnasium	Primary schools	Parish schools	Total
1805	49	279	142	469
1810	59	346	105	510
1815	36	311	47	394
1820	28	488	114	630
1825	90	555	274	919
1830	102	724	225	1,051
1835	58	783	244	1,085
1840	254	340	898	1,492
1845	228	396	906	1,530
1850	295	407	1,092	1,794
1855	307	512	994	1,813
1860	518	455	1,210	2,211

As evidenced in Table 1, the period 1805–1860 witnessed noticeable fluctuations in the size of the student body at the region's male gymnasium – especially in the first 30 years of its existence. At the same time, there was a similar situation with its parish schools. Nevertheless, starting in the 1840s the region witnessed a virtually continuous increase in the number of students in its educational institutions.

In 1862, the region became home to 13 male parish schools and 2 third-class female parish schools, i.e. primary schools. In 1863, the stanitsa of Ust'-Medveditskaya became home to the region's second male gymnasium. The following educational institutions were also established: 2 second-class female schools, 4 third-class female schools, and 11 male parish schools (Robush, 1867: 130).

In 1864, the region became home to 2 second-class female schools, 2 third-class female schools, and 8 male parish schools. In 1865, Don Host Oblast became home to another 8 parish male schools, and in 1866 – to another third-class female school and another 2 male parish schools (Robush, 1867: 131).

As at 1866, Don Host Oblast had three secondary-education gymnasiums (two male and one female) with a combined enrollment of 968 students, with 199 of those being girls. The region's lower educational institutions had a combined enrollment of 688 boys (enrolled across eight district schools) and 170 girls (four second-class schools). The primary education sector had a combined enrollment of 5,137 boys (97 male parish schools) and 479 girls (13 third-class female schools) (Robush, 1867: 131). Overall, in 1866 Don Host Oblast had a combined enrollment of 7,442 students, with 848 of those being girls (Robush, 1867: 131-132). As a reminder, all of the above-mentioned educational institutions were under the purview of the Ministry of Public Education.

The Great Reforms produced a substantial effect on the system of public education in Don Host Oblast. In 1873, the region now had 277 educational institutions. Its capital, Novocherkassk, had eight educational institutions: Novocherkassk Male Gymnasium (471 boys), District Lower Male School (218 boys), Mariinsky Don Institute (162 girls), Mariinsky Female Gymnasium (356 girls), Alekseyevsky Orphanage (200 girls), and three primary parish schools (403 boys). In all, Novocherkassk had a combined enrollment of 1,103 boys and 718 girls (Pamyatnaya knizhka, 1875: 1). The following district educational institutions operated in the region: Ust'-Medveditsk Gymnasium (218 boys), 2 male progymnasiums (169 boys), 4 female progymnasiums (268 girls), 3 district schools (231 boys), 14 third-class female schools (552 girls), 127 primary parish schools (7,345 boys and 874 girls), 117 rural schools (3,335 boys and 198 girls), and 1 monastery-based private school (33 girls). In all, this sector had a combined student body of 11,318 boys and 1,925 girls (Pamyatnaya knizhka, 1875: 2).

In 1892, Don Host Oblast had the following male educational institutions under the purview of the Ministry of Public Education: 4 gymnasiums, 3 real schools, 1 teacher's seminary, 1 progymnasium, 4 trade schools, 2 technical schools, 3 nautical schools, and a combined 388 district, urban, and rural schools. In addition, the region had the following female educational

institutions: 1 institute, 3 gymnasiums, 2 progymnasiums, 6 urban schools, 1 Armenian school, and a combined 35 parish schools and orphanages (Spravochnik..., 1893: 9-10).

In 1897, the total number of educational institutions under the purview of the Ministry of Public Education in the region was 715. The figure reached 749 in 1898 and 792 in 1899 (Pamyatnaya knizhka, 1901: 46).

In 1900, Don Host Oblast had the following secondary educational institutions: male – 3 gymnasiums, 4 real schools, 1 progymnasium, and 1 teacher's seminary; female – 1 institute for noble maidens, 4 gymnasiums, and 1 progymnasium (Donskaya oblast'..., 1902: 16). The region had the following lower educational institutions: male – 6 trade schools, 2 technical schools, and 3 nautical schools; female – 3 four-grade schools and 1 school for Armenian girls (Donskaya oblast'..., 1902: 16). The total number of primary schools in the region, inclusive of those under the purview of the Ecclesiastical Department, was a combined 1,518 schools for boys and both genders and 162 schools for girls (Donskaya oblast'..., 1902: 16).

Educational institutions under the purview of the Ecclesiastical Department

Parochial schools, based at churches and monasteries and run by the Russian Empire's Ecclesiastical Department, were present in the Don region from the 19th century. Normally, such schools were set up entirely on the initiative of local clergymen and were housed in their own dwellings or in back rooms temporarily designated for the purpose. As a result, there typically were serious issues concerning school equipment and supplies. Outmoded teaching methods were employed in teaching the children how to write, read, and count and no salaries were paid to the teacher-priests. Hence, this sector lacked stability. Nevertheless, in 1860, i.e. on the eve of the abolition of serfdom in Russia, Don Host Oblast had 105 parochial schools with a combined enrollment of more than 2,000 students.

While there were no major changes in terms of the organization of the educational process at the region's parochial schools immediately after the abolition of serfdom in Russia, the Great Reforms period did introduce the impetus in efforts to open more schools in the region. However, subsequently the number of such educational institutions decreased continually, with the figure dropping to a historical low in 1882. A new impetus in the development of this sector was provided in 1884. The Emperor signed into law a special regulation, *Rules on Parochial Schools*, and the Russian government provided the Ecclesiastical Department with funds for the organization of parochial schools and to cover teacher payroll in this sector. Eventually, this helped bring order and stability into the region's parochial school sector, with such schools getting equated in status to primary schools under the purview of the Ministry of Public Education. As early as 1900, Don Host Oblast had 497 parochial schools with a combined enrollment of more than 23,000 students.

Table 2 displays the data on parochial schools in the Don Diocese in 1860–1900.

Table 2. Parochial Schools in the Don Diocese in 1860–1900 (Izvlechenie iz otcheta..., 1862: 88; Izvlechenie..., 1867: 94; Izvlechenie..., 1871: 94; Izvlechenie..., 1875: 90; Izvlechenie..., 1879: 90; Izvlechenie..., 1884: 92; Vsepoddanneishii otchet..., 1886: 92; Vsepoddanneishii otchet..., 1888: 94; Vsepoddanneishii otchet..., 1901: 63; Vsepoddanneishii otchet..., 1902: 63)

Year	Number of schools			Number of students		
	Church schools	Literacy schools	Total	Boys	Girls	Total
1860	-	-	105	1,788	244	2,032
1866	-	-	121	2,296	318	2,614
1870	-	-	80	2,115	234	2,349
1874	-	-	34	927	152	1,079
1878	-	-	14	615	78	693
1882	-	-	4	92	28	120
1884	-	-	41	1,116	178	1,294
1886	-	-	125	3,780	598	4,378
1899	-	-	397	12,369	7,394	19,763
1900	-	-	497	14,347	9,224	23,571

When looking at Table 2, it is worth remembering that there was no distinction made in said period between parochial schools and literacy schools. In terms of the student body's gender composition, girls accounted for a mere 12 % of all students in 1860. More or less similar proportions persisted up until 1882, and only in 1884 did the gender balance begin to change.

In 1884, the number of girls was now 13.6 %, in 1886 – 13.9 %, in 1899 – 37.5 %, and in 1900 – 39.2 %. There was a similar state of affairs with the region's primary educational institutions under the purview of the Ministry of Public Education.

5. Conclusion

During the period 1790–1900, Don Host Oblast witnessed brisk development in its public education sector. In that time, serious work in this area in the region was carried out by the Ministry of Public Education and the Holy Synod. By 1900, the Don region had an entire network of schools, which included 15 secondary, as many lower, and more than 1,500 primary educational institutions. For a long time, the region experienced a significant gender imbalance (girls accounting for 10–15 % of the total number of students). In the late 19th century, this imbalance began to decrease, with the number of girls reaching 39 % in 1900 – a definite success in terms of making education equally accessible for both genders in the region.

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Social Portrait of Professors and Lecturers at the Novorossiya Imperial University in Odessa

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Abstract

The article represents the main history stages of the first higher education institution in Southern Ukraine from its academic staff perspective. Considering historiographical traditions, modern approaches as well as the defined social portrait of professors and lecturers at the Novorossiya Imperial University in Odessa, we generalized its organizational, academic, international and other transformations.

The analysis of different sources made it possible to single out features of the social portrait of university professors and lecturers (especially, those of world-famous graduates and members). Among them, there were founders of new scientific trends, theories, methodologies, schools, etc.

The social portrait of professors and lecturers at the Novorossiya Imperial University was established via analysis of classes, professions, job duties and other principles. Therefore, we found out that teaching duration determined staff contributions to university development. In such a way, many professors of the Novorossiya Imperial University became its honorary members.

The social and academic prestige of the Novorossiya Imperial University professors is explained by their membership in different societies (including the foreign ones).

It is stated that employees of the Novorossiya Imperial University came from different social and professional classes: nobles, petits bourgeois, clerics. Also, there were academic dynasties.

Keywords: higher education, professors, social portrait, educational policy, educational reform, educational access, sustainable development in education, education policy.

1. Introduction

As social phenomena, universities are a significant component of sociocultural, outlook and scientifical influence on creating a city community. With established academic institutions, cities

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got a specific title of academic ones. Therefore, universities became an integral part of the city image. Besides, universities inherited the local intellectual tradition they previously accumulated.

The origin of higher education in Southern Ukraine dates back to 1817 when the famous Richelieu Lyceum was founded. Initially, the lyceum worked as a noble boarding institution. In the 1830s, it became similar to a university entity (according to its structure and duties). A great contribution to such a reorganization was done by N.I. Pirogov, a famous scientist.

The Novorossiya Imperial University was founded in May 1865. It comprised three faculties: history and philology, physics and mathematics, law were taught. In 1900, the medicine faculty was created. After the February 1917 events, the Novorossiya Imperial University folded in 1920.

Today, the historical image archetype of the Odessa University covers three separate periods: the Novorossiya Imperial University (1865 till 1920); the Soviet higher education institution (1920 till the 1990s beginning); the modern European university (today).

The emergence of the first Southern Ukrainian university exerted a considerable influence on the intellectual, cultural and public life of the region. The government applied it for satisfying local needs and spreading its pan-Slavic dominance over the Balkans.

Within the first decades, the university employed a range of excellent lecturers and scientists. The most prominent among them were professors M.D. Zelinskii, I.M. Sechenov, I.I. Mechnikov, etc. Thanks to them, the institution rose to the world science standards. This level is being kept today as well.

Thus, derived from the Richelieu Lyceum and founded in 1865, the Novorossiya Imperial University became the fourth Ukrainian educational institution (after those in Lviv, Kharkiv and Kyiv). Its historic succession is directly conditioned by the industrialization of Ukrainian education and science.

2. Materials and methods

To prepare the manuscript, we have analyzed sources and documents to trace the academic community formation in Southern Ukraine from the 19th century end to the 20th century beginning. In particular, that concerns ministerial resolutions and other acts on higher education work in the Russian Empire (Tablitsa ustavov..., 1901; Dneprov, 2017; Naznacheniya, 1865; Obozrenie..., 1865–1917; Otchet..., 1865-1915).

Besides, we considered biographies of some professors and lecturers at the Novorossiya Imperial University (Odeski istoryky, 2009; Profesory, 2020; Vcheni, 2003; Naznacheniya, 1865).

A relevant historic source about the Novorossiya Imperial University is the Odessa Government Memory Book (Pamyatnaya knizhka, 1869-1916). It mentions common lists of officers, including those from the Novorossiya Imperial University.

The digitized funds of the Research Library at the I.I. Mechnikov Odessa National University provide many old and rare publications, books and periodical collections. Also, you can find here personal archives of university professors and lecturers (Arkhiv, 2022).

An important account for the institution history is the Novorossiya Imperial University Notes, a journal in 1867-1913. It comprised research results, some studies and translations by professors and lecturers of the university. Moreover, protocols of the university academic board were published here. Since 1909, the journal was split into topical publishing sections by university units: 1 – administration; 2 – history and philology; 3 – law; 4 – physics and mathematics; 5 – medicine. Annually, several volumes of the Notes were published. Totally, 113 volumes were printed (Zapiski..., 1867–1913).

All of these sources and documents allowed defining the social portrait of professors and lecturers at the Novorossiya Imperial University (from the social, class, age, professional and ethnical perspectives).

The research methodological base covers the principles of historicism, verification, consistency and objectivity of historical source analysis. They are realized within the application of general scientific and specific methods. For manuscript preparation, we used the historical-analytical method to process and arrange the researched data. The classifying method was involved to sort the source base. The biographical method made it possible to analyze the living path of professors and lecturers at the Novorossiya Imperial University within the current historical, sociocultural and political transformations in Ukraine. The comparative analysis method was applied to find a contrast between social portraits of academic staff at the St. Volodymyr Kyiv University (Lebid, Lobko, 2022), the Kharkiv Imperial University (Lebid, 2022; Lebid,

Shevchenko, 2021; Lebid, Stepanov, 2023), the Novorossiya Imperial University (Lebid, Degtyarev, 2023) and the Kyiv Theological Academy (Lebid, 2023).

Among general scientific methods, we should mention the historical, logical, chronological problem and structural system analysis.

3. Discussion

In this article, we would like to reflect the Novorossiya Imperial University history via biographies and activities of its professors and lecturers. Finally, we obtain their social portrait.

The analyzed biographical and other data on professors and lecturers of the Novorossiya Imperial University are derived from a made-up questionnaire. It is based on methodological recommendations of the Biographical Research Institute and the V.I. Vernadskii Central Academic Library of the Ukrainian National Science Academy.

To prepare the manuscript, the main sources were employment records of professors and lecturers of the Novorossiya Imperial University, academic board protocols, reports, curricula, journal articles, text materials (at the Odessa National University Academic Library, the Odessa Oblast State Archive, the university archive), publication card indexes. This list includes history studies of the university itself and other Odessa institutions. Also, history of science branches, biographies, encyclopedias, bibliographies and reference books are covered.

It is worth saying that various anniversary research papers do not define the social portrait of professors and lecturers of the Novorossiya Imperial University properly (Markevich, 1890; Odeski istoryky..., 2009; Popruzhenko, 1915; Domin, Khmarskyi, 2010; Yurzhenko et al., 1965; Odesskyi unyversytet..., 1991; Istoriia Odeskoho..., 2000; Odeskyi natsionalnyi..., 2015; Odesskij universitet..., 1940). They only partially contribute to determining approaches to the research of university education history in Southern Ukraine.

The corpus of publications on history of the Novorossiya Imperial University and its staff development is reasonable to sort by several topical sections.

Firstly, it is bibliographical and reference literature about professors and lecturers at the Novorossiya Imperial University (Odeski istoryky..., 2009; Profesory..., 2000; Profesory..., 2020; Vcheni..., 1995a; Vcheni..., 1995b; Vcheni..., 1995c; Vcheni..., 2003; Vcheni..., 2004; Orlov, 1866–1907; Naznacheniya..., 1865).

Secondly, that deals with works on general development trends of higher education in Ukraine and the Russian Empire within the 19th century till the 20th beginning (Andreev, 2009; Andreev, Posohov, 2012; Posohov, 2014; Posohov, 2017; Siropolko, 2001; Ursu, 2014). Here, general issues of university education development in the Russian Empire are considered. Besides, university sociocultural impact and intellectual space formation are discussed.

Thirdly, there is a section of papers on main activities of professors and lecturers at the Novorossiya Imperial University. Their academic and research achievements are reflected (Rennenkampf, 1909; Lyapunov, 1916; Sabinin, 1882).

Separately, we should mention contemporaries' memories and professors' obituaries. In them, valuable life facts within the Novorossiya Imperial University can be found (Novopokrovskij, 1916).

An education development researcher may be also interested in works by professors and lecturers at the Novorossiya Imperial University. As sources about the specific academic class, you can find here both scientifical and biographical data (Sabinin, 1882 and etc.).

4. Results

In 1817, Odessa created a prestigious educational lyceum. He was called in honor of Armand Emmanuel Sophie Septimanie de Vignerot du Plessis, 5th Duke of Richelieu and Fronsac. Various people taught here. Its history can be subdivided into two periods: 1817–1837 (secondary education) and 1837–1864 (higher education).

Its lyceum achievements are connected with D. Kniazhevich and N. Pirogov (administrators of the Odessa Educational District). The latter promoted the lyceum transformation into the university.

In May 1865, the Novorossiya Imperial University was founded on the basis of the Richelieu Lyceum. Today, it is the I.I. Mechnikov Odessa National University. Initially, at the university there were three faculties: history and philology, physics and mathematics, law. The medicine faculty was created in 1900. The first university rector was professor I. Sokolov. In 1920, the Novorossiya

Imperial University was reorganized into institutes: national education, social upbringing, physics and chemistry, professional education.

For defining the social portrait of professors and lecturers at the Novorossiya Imperial University, it is reasonable to study its history via the prosopographical portrait of the university academic staff. Among lecturers of the Novorossiya Imperial University, there were full-time and part-time employees, ordinary and extraordinary professors, associate professors, etc. The latter contributed to the total number of university lecturers (including those of the Novorossiya Imperial University). A significant academic role was played by assistants, prosectors, astronomers, librarians, museum curators, etc. Eventually, scholarship holders taught as well. However, they did not belong to the main staff. Their role was secondary.

The common problem of all universities in the Russian Empire was a permanent lack of the teaching staff. Some departments (art history, law history, etc.) did not have any full-time teachers for a while. On the contrary, there were many part-time employees.

A certain rise happened in the final stage of the Novorossiya Imperial University existence. In 1915, there were 36 ordinary and 16 extraordinary professors, 4 lecturers, 54 privat-docents and 18 part-time professors after 30 seniority years (Obozrenie..., 1865–1917; Profesory..., 2000; Profesory..., 2020; Vcheni..., 1995a; Vcheni..., 1995b; Vcheni..., 1995c; Vcheni..., 2003; Vcheni..., 2004). The sources show that the Novorossiya Imperial University had 145 persons teaching in 1865–1890 and 350 people working in 1890–1920 (Obozrenie..., 1865–1917; Profesory..., 2000; Profesory..., 2020; Vcheni..., 1995a; Vcheni..., 1995b; Vcheni..., 1995c; Vcheni..., 2003; Vcheni..., 2004).

The contribution of professors and lecturers to the university development was not equal (considering the teaching duration). For example, at the Novorossiya Imperial University, an ordinary professor I. Ivanov lectured for one term only while M. Ushinsky taught for almost a year. Most honorary ordinary professors worked at the university for 20–30 years. The longest teaching duration showed S. Yaroshenko – about 40 years. Other academic veterans were V. Petriashvili and P. Melikishvili (33 years), A. Kochubinsky and M. Lange (32 years), G. Peretiatkovich (31 years), V. Voitkovsky (30 years). The shortest teaching position was held by A. Almazov who died in some months after his assigning in 1912 (Obozrenie..., 1865-1917; Profesory..., 2000; Profesory..., 2020; Vcheni..., 1995a; Vcheni..., 1995b; Vcheni..., 1995c; Vcheni..., 2003; Vcheni..., 2004).

Additional authority for members of the Novorossiya Imperial University was taken via membership in prestigious research institutions. V. Rotert came to Odessa as a corresponding member of the Kraków Science Academy. V. Grigorovich belonged to the Saint Petersburg Science Academy. Being an Odessa lecturer, F. Leontovich was elected a member of the Serbian Research Society. Similarly elected persons were A. Kochubinsky (the Czech Science Academy), I. Linnichenko (the Saint Petersburg Science Academy), A. Kovalevsky (the Saint Vladimir Imperial University).

For its whole history, the Novorossiya Imperial University had 76 people as honorary members, 15 persons got the honorary doctor title (Markevich, 1890; Obozrenie..., 1865–1917; Profesory..., 2000; Profesory..., 2020; Vcheni..., 1995a; Vcheni..., 1995b; Vcheni..., 1995c; Vcheni..., 2003; Vcheni..., 2004). Sometimes, the honorary members were officials participating in the university development. For example, such a man was S. Witte who contributed to the medical faculty foundation. Other honorary members were outstanding home and foreign researchers.

Most honorary members acquired the title post factum (I. Sechenov, V. Grigorovich) or as lecturers of other educational institutions. A. Pavlov was the only person who got the honorary doctor title of the Novorossiya Imperial University as its valid employee. However, some honorary members and doctors of the Novorossiya Imperial University lectured here after obtaining the title itself. Other people worked at the Novorossiya Imperial University for several periods with long interruptions (Obozrenie..., 1865-1917; Profesory..., 2000; Profesory..., 2020; Vcheni..., 1995a; Vcheni..., 1995b; Vcheni..., 1995c; Vcheni..., 2003; Vcheni..., 2004).

Like all institutions within the turn of the 19th–20th century, males prevailed at the Novorossiya Imperial University (students and lecturers). The first female years were the 1910s. Being a graduate from the city of Nancy (France), M. Stanishevskaya was elected a privat-docent of the Infectious Disease Department. Previously, she had successfully defended her thesis at the Novorossiya Imperial University with the conferred DSc in Medicine degree (for the first time as a female). In the whole Russian Empire, such a case was rare among females.

The internal staff hierarchy of the Novorossiya Imperial University was typical. Determined by the statutes as of 1863 and 1884, the system included ordinary professors (usually DSc before

1884), extraordinary members (masters), associate professors and privat-docents (for selective courses). Sometimes, it was difficult to proceed to higher career stages. Besides, it happened when the thesis defense did not contribute to the career rise. For a while, A. Markevich and V. Lazursky could not proceed further from the privat-docent position.

Superior merit professors could be appointed privat-docents due to the lack of the corresponding vacancy. For the whole history of the Novorossiya Imperial University, there were 158 ordinary professors: 46 – history and philology, 55 – physics and mathematics, 35 – law, 22 – medicine. Moreover, 3 theology professors lectured for all faculties (Obozrenie..., 1865-1917; Profesory..., 2000; Profesory..., 2020; Vcheni..., 1995a; Vcheni..., 1995b; Vcheni..., 1995c; Vcheni..., 2003; Vcheni..., 2004).

Among extraordinary professors, the university totally had 59 people for all faculties: 11 – history and philology, 20 – physics and mathematics, 8 – law, 20 – medicine. Privat-docents were 300 lecturers: 42 – history and philology, 101 – physics and mathematics, 24 – law, 133 – medicine. Foreign language teachers were 14 members (Obozrenie..., 1865–1917; Profesory..., 2000; Profesory..., 2020; Vcheni..., 1995a; Vcheni..., 1995b; Vcheni..., 1995c; Vcheni..., 2003; Vcheni..., 2004). It should be underlined that most ordinary lecturers passed all stages of career growth at the Novorossiya Imperial University.

The Novorossiya Imperial University staff came from different social and professional classes. We managed to define 338 such cases. They were nobles (117 individuals), petits bourgeois (69 persons), clerics (65 people: Orthodox, Lutheran, rabbi). There were 27 soldiers, 19 peasants, 9 officials, 2 sailors, 1 Don Cossack, 1 craftsman. 8 teachers belonged to foreign citizens (Obozrenie..., 1865–1917; Profesory..., 2000; Profesory..., 2020; Vcheni..., 1995a; Vcheni..., 1995b; Vcheni..., 1995c; Vcheni..., 2003; Vcheni..., 2004).

The initial livelihood level of the Novorossiya Imperial University staff was various. For example, V. Rotert was a son of the Riga Bank director while his colleagues came from very poor families. Thus, L. Pisarzhevsky lost his father early and worked since the age of 14. As an orphan seminarian, P. Tsitovich went on foot 500 versts to the Kharkiv University. There were successors of parent professors and researchers: M. Lange, F. Korsh, M. Grot, B. Liapunov. Intellectual family representatives were V. Krusman, D. Kryzhanovsky. Many lecturers came from families of famous artists and public figures (Obozrenie..., 1865–1917; Profesory..., 2000; Profesory..., 2020; Vcheni..., 1995a; Vcheni..., 1995b; Vcheni..., 1995c; Vcheni..., 2003; Vcheni..., 2004).

Among the Novorossiya Imperial University members, there were also academic dynasties. Especially, that concerns the Malinins. N. Malinin graduated from the Novorossiya Imperial University and acquired the professor title. The same was done by his son Ivan who was elected a privat-docent of the history and philology faculty. The similar situation was for the Prendels, the Tanatarovs, the Mochulskys.

58 members of the Novorossiya Imperial University graduated from the Moscow University. Besides, people previously studied at the Saint Petersburg University (53), the Saint Vladimir University (28), the Saint Petersburg Medicine and Surgery Academy (26), the Kharkiv Imperial University (22), the Dorpat University (20). Other institutions' graduates: the Kazan University (11), the Warsaw University (4), the Saint Petersburg Pedagogical Institute (4), the Moscow Theological Academy (4), the Kyiv Theological Academy (3), the Kazan Theological Academy (3), the Saint Petersburg Institute for History and Philology (3), the Saint Petersburg Theological Academy (2) and the Nizhyn Institute for History and Philology (2) (Obozrenie..., 1865–1917; Profesory..., 2000; Profesory..., 2020; Vcheni..., 1995a; Vcheni..., 1995b; Vcheni..., 1995c; Vcheni..., 2003; Vcheni..., 2004).

The Novorossiya Imperial University teachers graduated from 12 foreign institutions as well. 3 persons came from the Heidelberg University. The Vienna University had 2 future members. 1 lecturer graduated from the Athens, Prague, Magdeburg, Leipzig, Naples, Bern and Nancy Universities. The same concerns the Berlin Polytechnical University, the Royal Gumbert Lyceum in Naples, the Freiberg University of Mining (Obozrenie..., 1865–1917; Profesory..., 2000; Profesory..., 2020; Vcheni..., 1995a; Vcheni..., 1995b; Vcheni..., 1995c; Vcheni..., 2003; Vcheni..., 2004).

The Novorossiya Imperial University staff belonged to 5 confessions. There were 409 Orthodoxes, 34 Protestants, 31 Catholics, 14 Jews, 2 Gregorian Armenians (Obozrenie..., 1865–1917; Profesory..., 2000; Profesory..., 2020; Vcheni..., 1995a; Vcheni..., 1995b; Vcheni..., 1995c; Vcheni..., 2003; Vcheni..., 2004). That reflected the general religion tendency in the Russian Empire.

According to their birth place, 374 members of the Novorossiya Imperial University came from 18 countries (for other people, we could not define the data). They were born in Ukraine (149), Russia (145), Georgia (13), Moldova (12); Poland and Belarus (9 each); Latvia (8); Lithuania and Finland (6 each); Estonia and Italy (3 each); England, Germany, Croatia and the Czech Republic (2 each); Bulgaria, Greece and Denmark (1 each) (Obozrenie..., 1865–1917; Profesory..., 2000; Profesory..., 2020; Vcheni..., 1995a; Vcheni..., 1995b; Vcheni..., 1995c; Vcheni..., 2003; Vcheni..., 2004). Many belonged to mixed races, which made it difficult to identify their origin.

5. Conclusion

The Novorossiya Imperial University was founded to develop higher education in the Russian Empire. The statute as of 1863 provided an opportunity to make radical changes in higher education. The Novorossiya Imperial University started its work with the temporary staff: ordinary and extraordinary professors, associate professors and foreign-language teachers. The staff was going to be reformed with 29 ordinary and 13 extraordinary professors (DSc), 16 associate professors and 4 foreign-language teachers.

Since its foundation, the Novorossiya Imperial University played a significant role in public life of the city and region. In particular, the academic staff actively participated in all-Russian events: archeological, statistical (1868), agricultural (1876). Besides, they were interested in local agricultural, entomological and other events.

The university organized a range of all-Russian congresses. In 1883, it held the 7th Congress of Naturalists and Physicians (over 1000 participants). In 1884, the university hosted the 6th Archeological Congress (over 370 researchers).

Like other institutions, the Novorossiya Imperial University was a complex public organism with teaching and extra-teaching functions. Its relevance was “the school life”. Regardless of official acts, the university policy exceeded the academic scope, which produced new ideas in the paradigm “university – city”. The social portrait study of the Novorossiya Imperial University staff proves a significant role and influence of the university on higher education image and city development.

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A History of Everyday Life in Female Schools Within the Kharkov Educational District (1860–1862). Part 2

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Abstract

This work explores the history of everyday life in female schools within the Kharkov Educational District of the Russian Empire in the period 1860–1862.

The principal sources for this study are the schools' annual reports for their first year in operation, published in *Tsirkulyar po Khar'kovskomu uchebnomu okrugu*. These reports were analyzed, key similarities and differences were identified between the female schools, and conclusions were drawn as to the extent of the influence of local factors on their operation. The schools were analyzed across the following seven aspects: 1) prehistory; 2) Board of Trustees; 3) staff pay; 4) student composition and tuition pricing; 5) teaching staff and the Pedagogical Council; 6) curriculum; 7) budget.

The work's second part is focused on Kozlov Second-Class Female School and Oryol Second-Class Female School. It gives extensive consideration to the local communities' attitude toward the schools, which is described in the reports in a fairly detailed manner. It was found that neither in Kozlov nor in Oryol did the local community have a very good understanding of what female education was for, with most girls there being totally unprepared for it when starting school. Of note are the two different approaches taken by each school's administration in that climate. More specifically, at Kozlov Female School a primary focus was on prestigious electives, instruction in fundamental sciences was limited, and the staff who taught these sciences did so for free. Oryol Female School offered just one prestigious elective (French), whilst instruction in core subjects there was fairly high-quality, it was done by male gymnasium teachers, and more of such courses were offered there than at most of the other female schools. There was a difference in the reaction of the two local communities to the above, too – whereas Kozlov witnessed a sort of vogue for placing girls in school, although, in actual fact, most of the parents were little interested in their

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child's schooling, the school in Oryol received a reputation as an institution for the poor and had not a single girl student from a well-off family (such girls typically attended a private boarding school). Thus, due to local differences between them, the female schools had different policies in terms of designing the curriculum and dealing with the local community. Technically, choosing not to embrace the fundamental curriculum of a male gymnasium and opting to focus on prestigious subjects could bring a school a situational benefit, making it attractive to a significant number of little-educated parents.

Keywords: history of pedagogy, female education, female schools, history of everyday life, Kharkov Educational District.

1. Introduction

The scholars E.D. Dneprov and R.F. Usacheva view Russia's early-1860s system of female schools under the purview of the Ministry of Public Education as a "public-private establishment" within which pedagogical councils enjoyed a maximum of rights, with the attainment of such rights for male gymnasiums and real schools being something that "many zemstvos, non-governmental organizations, and educational organizations would desperately strive for through the rest of the 19th century" (Dneprov, Usacheva, 2009: 139-140). As revealed by our previous analysis, the experience of several specific schools within the Kharkov Educational District attests to this perfectly. However, E.D. Dneprov and R.F. Usacheva's view of society's specific influence on the operation of female schools seems to differ completely from what is described in the schools' annual reports from *Tsirkulyar po Khar'kovskomu uchebnomu okrugu*. As shown previously, the successful Mariinsky Kharkov Female School and Lipetsk Female School enrolled many daughters of merchants, with the merchantry contributing significant funding to the upkeep of these schools (directly in Kharkov and through the city community, which included merchants and urban commoners, in Lipetsk). According to E.D. Dneprov and R.F. Usacheva, on the other hand, "female schools for members of all social classes in the late 1850s and early 1860s owed their emergence and spread most importantly to the Russian "middle class"" (Dneprov, Usacheva, 2009: 143). The researchers then also stress the "democraticity" of the female schools' student body, although they only limit themselves to two examples: Yekaterinoslav Female Gymnasium (formerly a first-class school) had in 1865 an enrollment of 99 female students, with only 11 of these being nobles; Tambov Female Gymnasium (a higher female first-class school) had in 1863 an enrollment of 46 noble commoners, 2 daughters of merchants, and 22 nobles (Dneprov, Usacheva, 2009: 143). However, in actual fact this information does not prove much, for, as was shown in the work's first part, during that time each female school had a special social appearance. For instance, of Mariinsky Kharkov Female School's 160 students, 78 were nobles, 64 were daughters of merchants, and just 19 were noble commoners, and of Lipetsk Female School's 78 students, just 4 were nobles and as many as 30 were daughters of merchants (plus there were 43 urban commoners).

Thus, in practice, female schools for members of all social classes could be oriented toward different specific estate and social population groups. On one hand, since they were opening for the purpose of spreading literacy among girls, it is logical that many of the schools were trying to bring education to those strata where women tended to receive little to no education (an example of this will be provided later below). Yet, on the other hand, as shown in the work's first part, since most female schools were funded by the local community they served, their administration was, above all, interested in support from the local elite, i.e. rich and influential citizens; it was about either enrolling well-paying girls from good families, which would help cover at least a portion of a school's expenditure (as was the case with Mariinsky Kharkov Female School), or receiving steady annual funding from the local community (Lipetsk Female School).

Hence, the relationship between a school and the local community it served was of special importance. As evidenced by the case of the Female Department of Kupyansk Uyezd School, without support from the elite a female educational institution would be doomed to poverty and without popularity among the locals – to a low number of students.

It is the issue of how a female school was building a rapport with a local community that was largely unable to comprehend the significance of female education that has not been explored up to now. *Tsirkulyar po Khar'kovskomu uchebnomu okrugu* appears to contain some interesting information on this. The work's second part will be focused on two schools whose reports communicate interesting information about the local community, the student body, a variety of issues faced in trying to interact with those people, and how those issues were tackled.

2. Materials and methods

The work is focused on the following seven aspects of the operation of the female schools under examination: 1) prehistory (crucial for understanding the status of an educational institution, yet not covered in some of the reports); 2) Board of Trustees; 3) staff pay (important to consider, as there is an obvious idealization in the literature of free-of-charge instruction in female educational institutions across the Russian Empire (Dneprov, Usacheva, 2009: 124)); 4) student composition and tuition pricing; 5) teaching staff and the Pedagogical Council; 6) curriculum (the suggestion about the schools' curricula being unified, even partially, with what was offered in the male gymnasiums (Dneprov, Usacheva, 2009: 118) appearing rather inaccurate); 7) budget. The reports examined in the present study contain a lot of other interesting information, overall serving as a highly valuable source in terms of describing the history of everyday life in female educational institutions in the Russian Empire. The caveat must be made here as to why this study does not consider one important narrative that is present in each school's report – the one about its students' successes in the first year of study. The thing is that these reports were published in the public domain, and they spoke of students' achievements exclusively in a positive light, compared with the aspects examined in the present study, which were described in a fairly impartial manner. With that said, as will be shown later below, since the public did not always understand the significance of female education, publications about poor student progress could have had a highly negative effect in terms of community support of those schools. Hence, since there is little objectivity in the content in those publications that praises students, this kind of material will be left out of account in the present work.

This part of the work will draw upon the annual reports for the following two educational institutions within the Kharkov Educational District, published in *Tsirkulyar po Khar'kovskomu uchebnomu okrugu* for 1861–1862, as the most informative sources for the truth about the attitude toward them of the local communities they served: Kozlov Second-Class Female School (Tsirkulyar..., 1862a: 140-147) and Oryol Second-Class Female School (Tsirkulyar..., 1861: 70-76). Of particular interest is the fact that in the climate of lacking community understanding of the significance of female education that both schools were facing their boards of trustees adopted completely different strategies for development, which eventually would produce diametrically opposite results.

3. Discussion

As noted earlier, the issue of interaction between society and female schools in the 1860s Russian Empire has been explored very little up to now. The scholars E.D. Dneprov and R.F. Usacheva, who address this issue in their fundamental monograph quite extensively, appear to pass education trends observed in certain regions of the Russian Empire off as common around the country. That being said, many of the assertions put forth by these authors appear to be insufficiently well-grounded and focused on developing the Soviet ideologemes. For instance, there is the claim that initially the only proponents of female education in Russia were its "innovative teachers and education figures" – as opposed to local communities (there is mention of an unwillingness to fund female education on the part of the residents of Kherson, Yaroslavl, and Ryazan Governorates) (Dneprov, Usacheva, 2009: 135). However, as we read further into the monograph, we will learn that the real improvements in the area of the establishment of new female schools witnessed across the Russian Empire actually came after the release of a special directive by the country's Minister of Internal Affairs, S.S. Lansky, who was a representative of imperial bureaucracy, not an innovative pedagogue (Dneprov, Usacheva, 2009: 135). According to E.D. Dneprov and R.F. Usacheva, some governorates welcomed S.S. Lansky's directive and others did not – however, the researchers provide no explanation of this fact (Dneprov, Usacheva, 2009: 135-137). Thus, while it follows from the monograph by E.D. Dneprov and R.F. Usacheva that there were differences in the public's attitude toward female education across governorates in the early-1860s Russian Empire, the researchers fail to explore the actual factors that governed community support for a female school.

Of note also is the article by T.Ye. Pokotilova and Ye.Yu. Oborsky, 'The Person, The Public, and the Government in the Development of Female Education in the Russian Empire' (Pokotilova, Oborskii, 2022: 72-80). This article, however, cites as the main reason behind community support for female education the fairly abstract "tradition of benefaction" (Pokotilova, Oborskii, 2022: 75). The authors associate the genesis of this tradition mainly with the work of the imperial government

(Pokotilova, Oborskii, 2022: 74). Consequently, they regard instances of community support for female educational institutions (mainly viewed through the lens of the Stavropol region) as a sort of given, something indissolubly associated with the "potential and ambitions of members of the merchantry, nobility, and city intelligentsia, who, on one hand, were interested in the modern development of their daughters and many of whom, on the other, took an active part in social-charitable work" (Pokotilova, Oborskii, 2022: 75). The authors, however, are silent on why local community members became interested in the "modern development of their daughters" more in the 1860s specifically, what led to the opening of a second-class female school in Stavropol, and why they chose female education specifically as the object of their charitable work. Thus, the specific practices that helped female educational institutions in the 1860s Russia attract the attention of the public have not been explored up to now.

It is worth noting that this part of the work will also briefly touch upon the operation of private female boarding schools in the Russian Empire, which it will do through the lens of the following two interesting articles – N.A. Mitsyuk's '"Education Is Not Only for the Living Room": The Phenomenon of Provincial Female Boarding Schools' (Mitsyuk, 2012: 3-9) and V.A. Veremenko's 'Boarding Schools in Russia in the Second Half of the 19th and Early 20th Centuries' (Veremenko, 2015: 33-38).

4. Results

Kozlov Female School (1861–1862)

1) *Prehistory*. The report provides no information on the history of the establishment of this school, with the exception of the fact that it began operation in the middle of a school year, on December 18, 1861 (Tsirkulyar..., 1862a: 140).

2) *Board of Trustees*. The school's Board of Trustees was to have a traditional composition: the trustee (the wife of an uyezd landed gentleman), the uyezd marshal of the nobility, the city mayor, the female principal, the Ministry of Public Education official (Supervisor for Kozlov Schools), and two elective members (elected from among Kozlov's nobles and merchants) (Tsirkulyar..., 1862a: 140). However, no principal was appointed for the school (possibly for financial reasons), with its management being performed by the Supervisor for Kozlov Schools personally, which he did for free (Tsirkulyar..., 1862a: 140). Thus, here we witness the most substantial deviation from the board of trustees composition prescribed by the country's legislation among the schools examined hitherto – one of this governing body's members was simply not appointed, with the office remaining vacant for the entire school year. Based on the report, the school's Board of Trustees mainly handled organizational-financial issues (e.g., budget distribution and control, determination of tuition fees, and guardianship over poor students), while pedagogical issues were the responsibility of the school's Pedagogical Council, whose activity is discussed in the greatest detail in the one for this school among all the reports examined (Tsirkulyar..., 1862a: 141-144).

3) *Staff pay*. For reasons unknown, Kozlov Female School rented a very expensive building – paying 500 rubles per year for it. (Tsirkulyar..., 1862a: 142). By comparison, the Female Department of Kupyansk Uyezd School was paying a rent of 85 rubles (Tsirkulyar..., 1862b: 177) and Lipetsk Female School – 150 rubles (Tsirkulyar..., 1862c: 189). Therefore, although in Kozlov, as in Lipetsk, the local city community and several private persons had agreed to make yearly contributions to the school's budget (and that, compared with Lipetsk, was even without asking in return that some of the girls be educated free of charge), achieving a no-deficit school budget was a problem. Besides, the school in Kozlov attempted to introduce full-featured instruction in elective subjects, with these including not only French but dancing as well and singing even becoming a free core subject (Tsirkulyar..., 1862a: 142-143). Most of the school's teachers (specifically, those of religious education, Russian, arithmetic, and geography) worked for free and instruction in both dancing and French was conducted by one of its educatresses (Tsirkulyar..., 1862a: 142). As a result, whereas Lipetsk Female School spent on pay for its staff (inclusive of housekeepers) 950 rubles in the year (of this amount, 350 rubles was paid to the teachers and 150 rubles to the principal assistant), Kozlov Female School paid, even inclusive of unpaid work, a combined 336 rubles and 30 kopecks to its pedagogical staff and another 36 rubles to its housekeepers over a half-year period (Tsirkulyar..., 1862a: 142). Understandably, this was fraught with danger to the very long-term existence of the school – however substantial the local community's financial contribution to its budget was, its large expenditure (much of this incurred in renting an expensive

building and running the ambitious French and dancing programs) made its Board of Trustees heavily resort to having instructors teach free lessons.

4) *Student composition and tuition pricing*. The situation in this school was somewhat ambiguous in relation to the student body as well. As in the Lipetsk school, here only the first and preparatory grades were in place in the first year, with students allowed to enroll in the preparatory grade without taking an exam (Tsirkulyar..., 1862a: 144). Based on the school's financial records, this grade was free to attend. By and large, the school's extremely low cash receipts from tuition matched the size of its Grade 1 enrollment, whilst there also was a separate revenue item – "voluntary contributions from students in the preparatory grade" (Tsirkulyar..., 1862a: 141). As a result, there was a significant disproportion between the two grades – whereas Grade 1 enrolled no more than 15 students, the preparatory grade had an enrollment of 104 (!), which would eventually prompt considering the cessation of admission to it (Tsirkulyar..., 1862a: 144). Of interest is the fact that, compared with the other educational institutions, this school's report provides a breakdown of the student body by social group. The two grades differed in this respect significantly – Grade 1 was dominated by daughters of nobles and merchants (5 daughters of hereditary and personal nobles, 2 daughters of members of the clergy, 4 girls representing the merchantry, 3 urban commoners, and 1 peasant), whilst the overwhelming majority of students in the preparatory grade were urban commoners (10 daughters of hereditary and personal nobles, 3 daughters of members of the clergy, 11 girls representing the merchantry, 67 urban commoners, 9 peasants, and 4 raznochintsy) (Tsirkulyar..., 1862a: 144). As a result, the school was faced with an interesting phenomenon – whereas Grade I was relatively stable (only one girl left the school in the year), the preparatory grade lost 20 % of its student body (21 girls) (Tsirkulyar..., 1862a: 144). Normally, the school's administration by all means refrained from expelling its students and tried to reason with parents who wished to remove their daughter from it, which, however, did not always work (Tsirkulyar..., 1862a: 145). Some of the claims such parents had against the school were fairly well-grounded (e.g., good students having to be part of a large class alongside bad ones) (Tsirkulyar..., 1862a: 145). However, most of those claims indicate the unpreparedness of the Kozlov community for regular female education. For instance, some parents did not like that girls attending the school were asked to dress plain and did not have to wear a crinoline, some were not happy with the school not practicing corporal punishment as a measure against naughtiness, and others wished that the learning program be limited to teaching students to read the Book of Hours and the Psalter (Tsirkulyar..., 1862a: 145). It follows from the report that Kozlov witnessed a sort of vogue for placing girls in school, which, however, was not something underpinned by a real interest in female education ("Many of the parents, while inspired by the example of others who had placed their daughter in the school, were still not fully aware of why that was needed" (Tsirkulyar..., 1862a: 145)). Even sadder was the situation with the intellectual development of the school's students ("Many of those enrolling in the school were noticeably characterized more by being barbarous and stupid as a result of being browbeaten than by exhibiting signs of some development, even if rather poor" (Tsirkulyar..., 1862a: 145)). On the other hand, many of those who became its students would take the high road in their schooling endeavors – only to be met with indifference on the part of their parents ("Some would never even bother to find out how well their child was doing in school" (Tsirkulyar..., 1862a: 145)). Furthermore, some parents would ask the school's administration not to overwhelm students with schoolwork and not to load them with it during the holidays (Tsirkulyar..., 1862a: 145-146). The official cost of tuition at this school (these fees would, apparently, have to be paid when in Grade 1) was 3 rubles, 6 rubles, and 10 rubles per year, depending on one's financial circumstances, for core subjects and 15 rubles for electives, with there existing the possibility of poor girls being exempted from tuition fees at the discretion of the Board of Trustees (Tsirkulyar..., 1862a: 142).

5) *Teaching staff and the Pedagogical Council*. Unfortunately, the report for this school provides no information on the education level and main place of employment of most of its instructors. A noteworthy fact is that the school's teaching staff included a large number of persons of ecclesiastical status (besides its teacher of religious education, it also employed two clergymen as its chief instructors in the preparatory grade and instruction in singing was conducted there by a clerk vicar) (Циркуляр, 1862a: 143). Despite the fact that many of the school's teachers worked for free, its Pedagogical Council would regularly hold sittings and discuss common issues relating to female education. In fact, among the female educational institutions considered in this study, this school's was the only pedagogical council to offer detailed explanations regarding the logic behind

the design of the curriculum – and, as was the case in many other female educational institutions within the Kharkov Educational District, the school's administration would have to base its judgment on what was practicable rather than desirable. For instance, when certain instructors suggested using a better, more state-of-the-art textbook available on the market, the administration opposed it, citing both complexity and price as the reason (Tsirkulyar..., 1862a: 143). The idea of teachers producing lesson material ("notes") based on various books, i.e. creating a textbook of their own design, was rejected on the grounds that not all instructors were prepared to do it for free or for a small remuneration and some of those prepared to do it were doubted as capable of doing it the right way (Tsirkulyar..., 1862a: 143). Based on a piece published by a Novocherkassk Host Gymnasium teacher, A.M. Savel'yev, in *Tsirkulyar po Khar'kovskomu uchebnomu okrugu*, while the practice of teachers creating "notes" was a fairly common one in the Kharkov Educational District in the early 1860s, it mostly was done out of vanity and most of such notes were poor quality (Tsirkulyar..., 1863: 65-67). A.M. Savel'yev describes his own experience in this area as follows: "I didn't know where to start, what to do, or what sources to use. Yet I was spurred on by ambition; the desire to uphold my reputation amongst others made me work hard and assiduously. My predecessor had used notes – accordingly, I would want to have mine too" (Tsirkulyar..., 1863: 67). Thus, while rejecting the idea of having teachers create "notes" may have been a well-justified move, doing so left the following two options – either not use textbooks in class altogether (this was not approved by the Pedagogical Council, which reasoned that it would be wrong to rely on student memory alone) or utilize textbooks accepted in the Kharkov Educational District for use in the uyezd schools (this was approved) (Tsirkulyar..., 1862a: 143). In the end, the decision was made to model the school's curriculum after what was used in the uyezd schools (Tsirkulyar..., 1862a: 143). That said, the Pedagogical Council did try to adapt instruction in this educational institution to the capabilities of its students. The report for Kozlov Female School contains detailed information about how the Pedagogical Council discussed "various ways of instruction" and describes the ways that were selected in the end (Tsirkulyar..., 1862a: 143-144). For instance, in teaching prayers in the preparatory grade, the first step was to explain each word separately, then each word combination, and lastly the overall meaning of a prayer (Tsirkulyar..., 1862a: 143). With that said, the aim for the teacher of religious education was not so much to explain to students a particular prayer but provide them with a "clear understanding of the importance, lofty significance, and sanctity of prayers", with a view to cultivating in them a "sense of religious piety" (Tsirkulyar..., 1862a: 143). Geography lessons in Grade 1 were conducted pretty much in the form of free conversation, with the aim of "arousing curiosity in students and making them want to find out the causes of various natural phenomena" (Tsirkulyar..., 1862a: 144). While not all decisions made by the school's Pedagogical Council were worthwhile, it was the only educational institution among those examined in this study whose annual report attested that its Pedagogical Council discussed not only what was to be taught but also how to teach it, which was particularly important in a climate where the local community was not fully prepared for female education.

6) *Curriculum*. Since the female schools in Kozlov and Lipetsk modeled their curricula after the uyezd schools', one would have expected them to be fairly similar. However, that was not the case in practice. The differences between the two curricula boiled down to two major characteristics. Firstly, as shown earlier, Lipetsk Female School completely gave up on electives, whilst Kozlov Female School introduced French and dancing, which were not on the curriculum in the uyezd schools but were taught in several other female schools. Secondly, possibly because Kozlov Female School did not pay teachers for lessons, the number of core subjects taught there was much smaller than in Lipetsk Female School, especially in the preparatory grade (as a reminder, the school in Lipetsk had the same set of subjects in the preparatory grade and Grade 1). Ultimately, the preparatory grade taught just four subjects – religious education, reading, penmanship, and handwork (there was no arithmetic, history, and geography compared with the school in Lipetsk) (Tsirkulyar..., 1862a: 143). Grade 1 taught religious education, Russian, geography, arithmetic, penmanship, handwork, French, and dancing (i.e., compared with the Lipetsk school, there was no history but there were French and dancing) (Tsirkulyar..., 1862a: 143). Thus, in practice, the curriculum at Kozlov Female School was noticeably different from that of a regular uyezd school, which primarily had to do with the introduction of the prestigious subjects into it.

7) *Budget*. The situation in this area was rather ambiguous. On one hand, Kozlov Female School earned a decent annual income, well comparable to that of the financially fit Lipetsk Female School. As in the case of the latter, its main source of income was yearly donations from the caring

local community, with 838 rubles and 50 kopecks coming from the city community, 600 rubles – from members of the Board of Trustees, and as much as 745 rubles – from different private individuals (Tsirkulyar..., 1862a: 141). This comes to 2,183 rubles and 50 kopecks, i.e. nearly 1.5 times the amount contributed to the budget of the female school in Lipetsk (1,473 rubles and 80 kopecks). That said, the school earned a modest, if noticeable, income from student tuition fees – 94 rubles and 50 kopecks from fees for core subjects, 58 rubles and 50 kopecks from fees for electives, and 233 rubles and 20 kopecks from voluntary contributions from its students in the preparatory grade (Tsirkulyar..., 1862a: 141). Leaping ahead a bit, it is worth noting that this theoretically earned Kozlov Female School the largest annual income among the schools examined in this study (except for Mariinsky Kharkov Female School). In practice, however, there was an issue that was similar to the one with student enrollment – a sizable portion of the school's benefactors, including the city community, had committed themselves to contributing large sums – but in actuality, only some of that money was provided, with the school's receipts in the first school year (inclusive of one-off contributions and several other sources of income not mentioned above) amounting to 2,391 rubles and 50 kopecks; the unreceived 518 rubles and 58 kopecks in promised annual donations was treated as arrears (Tsirkulyar..., 1862a: 141). The school's expenditure was 1,311 rubles and 60 kopecks (Tsirkulyar..., 1862a: 142). However, it must be taken into account that during the school's first year in operation it had no spending on major expense items such as pay for the principal (as a reminder, Lipetsk Female School paid its principal 300 rubles per year) and pay for teachers, with most of its teachers doing it for free (Lipetsk Female School spent on this 350 rubles per year). As we can see, while Kozlov Female School could technically continue having a no-deficit budget in the future, even with someone in office as Principal and teacher pay in place, that required the continuation of support from the local community – and that support was unprecedented even vis-à-vis Lipetsk's. The problem was that a large portion of the Kozlov community was treating the idea of female education as a sort of vogue and did not have a clear idea of what it was for, which was reflected both in promised contributions not being provided to the school and in parents seeking to remove their daughters from it.

Kozlov Female School could be regarded as the most controversial and unbalanced of the schools examined in this study. This educational institution, while behind Mariinsky Kharkov Female School by a large margin in terms of one-off donations, enjoyed the largest volume of annual contributions from the local community. However, in actual fact, a significant portion of these funds were not put to use. The school rented an expensive building. Unlike the other uyezd female schools, it taught dancing, but it did not have a principal and many of its teachers worked for free. Over the year, it had an enrollment of 119, which was a definite success. However, 22 of its students were removed from the school by parents – some for reasons fairly absurd, like the absence of corporal punishment there. Nevertheless, judging by the report's detailedness and the unprecedented cogency of the opinions expressed by the Pedagogical Council, this unbalancedness was hardly due to carelessness and thoughtlessness. The school's administration may have been specifically trying to create for it the image of a prestigious, and even swanky, educational institution, where girls would be treated as high-society ladies, being taught not only the sciences but French, and even dancing – believing that this approach would help it win over the community. At any rate, the importance of a school's prestige is attested to by the report for Oryol Female School.

Oryol Female School (1860–1861)

At first glance, Oryol Female School comes across as the most successful of the female educational institutions examined in this study, except, of course, for Mariinsky Kharkov Female School, which was located in a university town. First of all, Oryol, unlike Kupyansk, Lipetsk, and Kozlov, was a gubernia town, not an uyezd one, which potentially promised it greater attention on the part of the authorities and the possibility of enlisting teachers from the gubernia gymnasium to work in the female school. Second of all, only here was the female school not created from scratch (it was the product of a merger with a local female parish school, which originated in 1840) (Tsirkulyar..., 1861: 74-75). However, the first-year report for this educational institution paints a fairly bleak picture in terms of operation, and that is despite the fact that Oryol Female School was in a pretty solid situation in terms of both revenue and pedagogical staff.

1) *Prehistory*. In addition to organizational errors, it is the school's prehistory that played the most negative role in its operation. An educational institution known as Lancasterian School for Girls was opened in Oryol back in 1840. Subsequently, it was transformed into a female parish school, which in 1860 had an additional grade, where teachers from the uyezd school provided free

instruction in religious education, Russian grammar, arithmetic, history, and geography (Tsirkulyar..., 1861: 75). According to the report, this educational institution was popularly known in Oryol as "the philistine school" (Tsirkulyar..., 1861: 75). The new school gradually absorbed the female parish school. The bulk of its first cohort was enrolled from among the student body of the female parish school (Tsirkulyar..., 1861: 74). Furthermore, at that time Oryol had two private female boarding schools, which, unlike the "philistine school", enjoyed a solid reputation with the influential segment of the local community; ultimately, even at the end of its first school year this school's student body included no children from wealthy families of nobles, officials, and merchants, whereas in the private boarding schools, where tuition was 20 times more expensive, the enrollment was nearly 50 students (Tsirkulyar..., 1861: 74). As we can see, what could have become the formula for the school's successful operation (its long history and being located in a gubernia town) did it, in actual fact, a disservice – the reputation of the educational institution that the school was established on the grounds of was not that great and the town already had competitors that were more successful. As a result, Oryol Female School was the only one of the educational institutions considered in this study to find itself in a competitive environment – to achieve more effective development it would need to find a way to woo students away from the private female boarding schools. It was about not so much the actual student body and how much could be earned from tuition fees but the attention and support of their parents, the rich segment of the local community, and potential benefactors.

2) *Board of Trustees*. Of note is the fact that Oryol Female School had the largest Board of Trustees, which, apart from regular members, also included honorary ones. It was composed in a regular manner – the female trustee (first it was the wife of the governor and later it was the wife of the marshal of the gubernia nobility), the uyezd nobility marshal, the city mayor, the Ministry of Public Education official (Director of Oryol Schools), the female principal, and two elective members (elected from among Oryol's nobles and merchants) (Tsirkulyar..., 1861: 70-71). The Board of Trustees also included three honorary members – two guards officers and an active state councilor (Tsirkulyar..., 1861: 71). The report does not explain the principle behind the choice of these members; what is known is that one of them, Rittmeister N.V. Kireyevsky, was a donor of 10,000 rubles toward the establishment of the female school (Tsirkulyar..., 1861: 71). Thus, an honorary member of the school's Board of Trustees would be someone who had done a lot to help the school open or operate. A fact worthy of note is that female schools in the Russian Empire became statutorily empowered to expand their boards of trustees only in 1862 (Dneprov, Usacheva, 2009: 140). Evidently, the practice of expanding a board of trustees with generous benefactors was allowed in the Kharkov Educational District before it was at the national level, which once more goes to show the importance of regional characteristics to the operation of female schools in the early-1860s Russian Empire.

3) *Staff pay*. The significant volume of contributions helped pay teachers and educatresses at Oryol Female School very well – almost as well as at Mariinsky Kharkov Female School. Specifically, its female overseer was paid 300 rubles – the same as educatresses at Mariinsky Kharkov Female School (Tsirkulyar..., 1861: 72). The report helps calculate the school's teacher pay based on the rate for the "annual lesson". Specifically, the teacher of religious education would be paid 100 rubles at 4 lessons per week (i.e., 25 rubles per "annual lesson"), the teacher of Russian – 210 rubles at 6 lessons (35), the teacher of mathematics – 140 rubles at 4 lessons (35), the teachers of history and geography – 175 rubles at 5 lessons (35), the teacher of natural history – 70 rubles at 2 lessons (35), and the teacher of penmanship – 120 rubles at 6 lessons (20) (Tsirkulyar..., 1861: 72). As a reminder, while Mariinsky Kharkov Female School paid its teachers of these subjects (with the exception of penmanship) 40 rubles per annual lesson, it had a system of deductions for missed classes (something that Oryol Female School did not do, as suggested by its budget figures); in fact, its teacher of penmanship was paid 20 rubles. Thus, overall the situation with staff pay was noticeably better in Oryol Female School than in most of the female schools in the Kharkov Educational District, which gave it the potential to enlist good pedagogues. That said, Oryol Female School did have cases of staff working for free, such as its principal and teacher of drawing refusing to accept remuneration for their services (Tsirkulyar..., 1861: 70, 72).

4) *Student composition and tuition pricing*. Here the situation was the worst. As shown earlier, most of the female schools in the Kharkov Educational District considered in this study had preparatory grades with large enrollments. However, in Oryol Female School the role of such a grade was played by the female parish school, merged with it, which enrolled as many as

138 students at the school year end (Tsirkulyar…, 1861: 75). On the other hand, enrollment in the actual newly established school was highly limited, as it would accept only girls with a level matching a first-grade level of knowledge at least, although, as shown earlier, parents representing the area's wealthy families, i.e. ones with the most educated girls, typically preferred placing their daughter in a private boarding school. Ultimately, Oryol Female School was the only of the educational institutions considered in this study to actually witness a decline in the size of the student body in the first school year – it started the first year with an enrollment of 28 girls, mainly students from the parish school; during that school year, 4 new students joined it and 6 students left it (Tsirkulyar…, 1861: 72). Thus, at the school year end it had an enrollment of just 26 students, most of whom were daughters of minor officials – 3 daughters of hereditary nobles, 11 daughters of personal nobles, 1 daughter of a person of ecclesiastical status, 3 girls representing the merchantry, and 8 urban commoners (Tsirkulyar…, 1861: 72). A factor that held out the prospect of a good future for the school was that the establishment of a not-so-successful new school was breathing new life into the parish female school – whereas it retained just 49 learners from the former student body, during that year it admitted 91 new students, two students left it, and three of its students passed away (Tsirkulyar…, 1861: 75). In terms of social composition, the parish school was still dominated by urban commoners – there were 32 daughters of hereditary and personal nobles, 25 girls representing the merchantry, and 81 urban commoners (Tsirkulyar…, 1861: 75). The size of the student body at the female school could increase via the enrollment of students from the parish female school, but that only strengthened the link between the new educational institution and the old "philistine school", which was unpopular with the area's wealthy residents. What additionally complicated the situation was the extremely low level of preparation among students, which, as in Kozlov Female School, was associated with a lack of support for the education of the girls within their families. The annual report provides the following unflattering characterization of the school's student body: "Nearly every single student from a poor family at the school was characterized by a lack of any sort of development and a complete absence of preparation, i.e. of something that is such a boon to any educational institution and an indicator of parents' efforts to bring up their children in a proper way, i.e. with school in mind" (Tsirkulyar…, 1861: 73). As regards tuition, which was not free (the report mentions no cases of enrolling non-paying students), it would cost between 3, 5, and 12 rubles to attend a core course depending on one's financial circumstances (Tsirkulyar…, 1861: 71). The report provides no information on the school's tuition fees for elective courses.

5) *Teaching staff and the Pedagogical Council*. The school's relatively high staff pay helped form the male segment of its pedagogical workforce not from instructors of the local uyezd school but from teachers of the gubernia gymnasium, both junior and senior (Tsirkulyar…, 1861: 71). Only instruction in religious education was conducted by the local archpriest and drawing was taught by a teacher from the uyezd school (as a reminder, the drawing teacher worked for free) (Tsirkulyar…, 1861: 71). The annual report for this school even stresses that it outdid the city's private boarding schools in terms of the caliber of the teaching staff (Tsirkulyar…, 1861: 74). Things typically were more complicated with the female segment of the school's pedagogical workforce. Apart from the principal and the overseer, its female members also included the teachers of French and handwork. The report says nothing about the educational background of the French teacher, who combined her position with the post of overseer (Tsirkulyar…, 1861: 71). Of note is what occurred in Handwork class – a rather curious happening. Specifically, on February 1, 1861, the lady who taught this class had to leave the school for reasons not mentioned in the report; the school would hire a substitute teacher only on March 1, 1861 (Tsirkulyar…, 1861: 71). Thus, even offering a good salary, good enough to interest male instructors from the local gymnasium, would not guarantee back then hiring a good female instructor easily in a small gubernia town. While pretty active, the school's Pedagogical Council would discuss methods of teaching in a more general way than its counterpart at Kozlov Female School. Nevertheless, the annual report contains the interesting assertion that the school was able to succeed in teaching initially low-achieving students only thanks to its skilled pedagogical team (reportedly, each of its male science instructors was an "individual with a higher education and someone who had developed the proper tact as a teacher after just a few years of working as one" (Tsirkulyar…, 1861: 73)). The report also brings up several issues that were left unresolved by the Pedagogical Council (e.g., some of the school's impoverished students being unable to purchase the required study guides in the entire school year) (Tsirkulyar…, 1861: 73).

6) *Curriculum*. Rather contentious, it was more fundamental than that of most of the educational institutions considered in this study. Apart from the usual set (religious education, Russian, arithmetic, history, geography, penmanship, and handwork), the school's core subjects also included drawing and natural history, both added to the curriculum with permission from the administration of the Kharkov Educational District (Tsirkulyar..., 1861: 72). Thus, this school would provide its students with knowledge in natural science that was atypical for the normal curriculum of female schools within the Kharkov Educational District. The report stresses that the school's curriculum was much larger than that of the local private boarding schools (Tsirkulyar..., 1861: 74). However, as noted earlier, this merit of the school was of no particular interest to the local community. On the other hand, things were extremely challenging there with elective courses. The only elective offered by the school was French (Tsirkulyar..., 1861: 71). However, it was not taught in actual fact – the report openly states that the curriculum included no "new languages" (i.e., French or German) (Tsirkulyar..., 1861: 74). This may have been due to the school having received no payment for that class from its poor students. Consequently, the curriculum at Oryol Female School was the complete opposite of the one at Kozlov Female School – it included more fundamental sciences (by virtue of natural history) than that of most of the female schools but not a single prestigious subject. And, as acknowledged in the annual report, this choice of fundamental, yet unprestigious, education for girls was a critical mistake by the school. It was the absence of new languages, music, and dancing on the school's curriculum that was believed to be a major reason behind the lack of attention to it on the part of the wealthy segment of the local community, in addition to its prehistory and the prevalence in it of students from the "philistine school" (Tsirkulyar..., 1861: 74). According to the report, the school's Pedagogical Council had discussed this issue more than once – but to no avail, with a lack of funding typically cited as the reason (Tsirkulyar..., 1861: 74-75). However, in actuality, based on the experience of some other female schools, Oryol Female School could well have expanded its offering of elective (prestigious) courses for girls, but that would have been possible only at the expense of reduced pay for its fundamental science instructors, which must have been unacceptable to its Board of Trustees.

7) *Budget*. A distinctive characteristic of Oryol Female School was that it had some sizable capital that it put out at interest. This is how it used the sums of 10,000 (donated by N.V. Kireyevsky) and 6,000 rubles (from other private individuals) (Tsirkulyar..., 1861: 71). Another 3,300 rubles was left from the parish female school (Tsirkulyar..., 1861: 71). In all, the interest earned on these sums was 911 rubles in the year (Tsirkulyar..., 1861: 71). A little more came in from annual contributions provided based on a principle we are already familiar with – the City Duma being the biggest donor (989 rubles and 55 kopecks in the year), followed by members of the Board of Trustees (300 rubles). Private individuals had agreed to pay the school just 175 rubles per year – and not on a regular basis but for the first 3 years (Tsirkulyar..., 1861: 71). The school's income from tuition fees was around 125 rubles (Tsirkulyar..., 1861: 71). Thus, the total annual income for Oryol Female School was 2,500 rubles and 55 kopecks, which was a little less than that for Kozlov Female School (or a little more, if we are to look at the latter's income exclusive of arrears) (Tsirkulyar..., 1861: 71). However, even though it earned that much, because of paying high salaries to its staff and renting an expensive building the school in Oryol ended up being the only of the educational institutions considered in this study to have a deficit budget at the end of the first year in operation, even taking donations into account – its expenditure that year amounted to 2,526 rubles and 15 kopecks (Tsirkulyar..., 1861: 72). A major expense item for the school was staff pay, with 815 rubles going to pay the instructors of the school, 367 rubles and 15 kopecks going to pay the instructors of the female parish school, 468 rubles going to pay the overseer, the handwork teacher, and the records manager, all of whom worked in both schools (Tsirkulyar..., 1861: 72). Among the rest of the expense items, the biggest were rent (400 rubles) and utilities (350 rubles) (Tsirkulyar..., 1861: 72). Evidently, the school, indeed, had no budget reserves available, with any new expenditure being possible only through cuts in spending. Operating in a climate of indifference on the part of the community, the school was actually faced with the prospect of losing a portion of its income from annual contributions.

On balance, the female school in Oryol had the least promising situation among those considered in this study (with the exception of the Female Department of Kupyansk Uyezd School). And that was despite the fact that, arguably, it was doing everything right from a pedagogical standpoint – there was a focus on teaching fundamental sciences rather than prestigious subjects and its curriculum included not only humanities and mathematics subjects but natural disciplines

as well, it had a well-qualified team of teachers, and it offered decent pay. However, it appears that the school had failed to coordinate its strategy for development with the views of the public – the Oryol community may have been unprepared to embrace a version of female education focused on fundamental sciences as opposed to prestigious subjects. As a result, the wealthiest and most influential segment of the Oryol community was mainly indifferent toward the new female educational institution. While it did receive substantial contributions from individual enthusiasts, most of Oryol's wealthy residents preferred placing their daughters in a private boarding school with a stronger focus on teaching prestigious subjects and a weaker fundamental science curricular component. This led to Oryol Female School being stigmatized as a "philistine", low-status educational institution. The situation could have been improved by the inclusion in the curriculum of prestigious foreign languages, music, and dancing, but that was being thwarted by the paying of high salaries to its fundamental science teachers – there simply were no budget reserves left. Also, instead of putting out at interest the funds donated by benefactors, the school might possibly have been better off investing them in boosting its popularity during the first years in operation (e.g., once again, by way of including prestigious subjects in the curriculum).

5. Conclusion

The existing research on the subject (above all, the monograph by E.D. Dneprov and R.F. Usacheva) considers the following two variants of the public's attitude toward a female school in the early-1860s Russian Empire: 1) support in the form of making financial contributions to and placing girls in it; 2) refusal of support, i.e. refusing to provide it with financial assistance, which would make the proper operation thereof impossible. The exceptional cases of Kozlov Female School and Oryol Female School indicate the possibility of there being a third variant – there being a sort of vogue for placing girls in school, with the locals financially supporting the opening of a female school without having a clear idea of why that was necessary. In a climate like that, an already running school would have to look for ways to attract the attention of local residents and ensure that placing girls in school was not a vogue but a necessity for members of different strata of society.

Each faced with a lack of community understanding, Oryol Female School and Kozlov Female School went different ways. Oryol Female School acted in line with a set of trends that tend to be idealized in the modern literature – its curriculum and teaching staff converged with the male gymnasium's and its student composition was fairly democraticized owing to the prevalence of girls representing the urban commoner social group. In practice, however, this strategy turned out to be not very successful – the school had a reputation of being an unprestigious educational institution ("the philistine school"); wealthy families would not enroll their girls in it and all of its financial reserves would be used to pay the staff. By contrast, Kozlov Female School curtailed significantly its fundamental science curriculum but introduced instruction in prestigious subjects (French and dancing). As a result, it became a vogue amongst the local community to place girls in it, although what that was for was not always clearly understood by local residents, with things getting as absurd as some parents removing their daughter from the school only because she was not made to wear a crinoline (i.e., going to school was for some like taking part in a sort of fashion show). There even was misunderstanding regarding the already curtailed curriculum – some parents considered it too complex and impractical, asking that children not be overwhelmed with schoolwork.

Thus, the issue of how female schools built their relationship with the public in 1860s Russia does merit separate study. It is important both from the standpoint of such schools, whose operation depended wholly on support from the local community, and from the viewpoint of the history of the woman question in the Russian Empire, as it reveals variants of the public's attitude toward female education that are more complex than just support or refusal of support.

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The Parochial School Sector in the Russian Empire (1866–1886): The Shift from the Purview of the Zemstvos to That of the Holy Synod

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Abstract

This study explores the movement of the parochial school sector in the Russian Empire from the purview of the zemstvos to that of the Holy Synod. Its chronological scope is from 1866 to 1886.

The study's findings revealed that 1884 was a watershed year for the country's parochial school sector, as that is when the Russian Emperor signed into law the so-called *Rules on Parochial Schools*. This event brought to an end the 18-year period of parochial schools being under the purview of the zemstvos in the Russian Empire, during which this sector had descended into a state of crisis – a 4-times drop in the number of parochial schools in the country relative to 18 years earlier. However, different dioceses in the Russian Empire fared differently during that period. Specifically, the Kiev Diocese lost 25 % of its schools in a 16-year period (from 1,349 schools in 1866 to 1,064 schools in 1882), but the figure was almost restored in the subsequent 5 years (1,275 schools). There was a similar situation in some other Ukrainian dioceses (e.g., the Podolia Diocese). The experience of the Kiev Diocese indicates that the local clergy and zemstvos were able to reach a compromise in the area of public education. A completely opposite example is the case of the Lithuanian Diocese, where the number of parochial schools dropped more than 50 times in the same 16-year period (from 430 to 8) – but then increased nearly 100 times in the subsequent 5 years (from 8 to 792). Thus, the period 1866–1886 was peculiar geographically – the greatest success in preserving the school potential in 1866–1882 was achieved by Ukrainian dioceses, whilst the most dynamic rehabilitation of the parochial school sector in 1882–1886 was exhibited by Baltic and Belarusian dioceses.

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1. Introduction

On June 13, 1884, Emperor Alexander III signed into law the so-called *Rules on Parochial Schools*, developed by the Holy Synod. The introduction of this regulation would radically change the situation with parochial schools in the Russian Empire, dividing time into two major periods – one before the adoption of the Rules and one after. This study seeks to explore the operation of the parochial school sector in the Russian Empire from 1866 to 1886, i.e. in the 18-year period before the adoption of *Rules on Parochial Schools* and in the 2-year period after that.

2. Materials and methods

The best source for statistics on the operation of parochial schools under the purview of the Holy Synod in the Russian Empire has been the yearly *Most Faithful Report of the Chief Procurator of the Holy Synod*. Use in this study was made of this publication for 1866 and the period 1882–1886. The particular focus on these timeframes is also associated with that a sample of just 1 year may not be considered a representative one, as certain dioceses did not provide data on the numbers of schools within them and students in those schools each year. For instance, no data were provided in 1882 by the Yeniseysk, Kamchatka, and Yakut Dioceses and the Georgian Exarchate (Izvlechenie iz vsepoddanneishego otcheta..., 1884: 93). In 1883, no data were provided by the Vladimir, Don, Yeniseysk, and Turkestan Dioceses (Izvlechenie iz vsepoddanneishego otcheta..., 1885: 93), in 1884 – by the Vologda, Yekaterinoslav, Yeniseysk, Kiev, Lithuanian, Minsk, Mogilev, Oryol, and Kherson Dioceses and the Georgian Exarchate (Vsepoddanneishii otchet..., 1886: 93), in 1885 – by the Yekaterinburg, Kiev, and Lithuanian Dioceses (Vsepoddanneishii otchet..., 1887: 93), and, lastly, in 1886 – by the Vologda and Irkutsk Dioceses (Vsepoddanneishii otchet..., 1888: 94).

The study's methodology is grounded in a set of major historical principles – systematicity, historicism, and objectivity. The use of these principles made it possible to conduct an analysis of social processes within Russia's parochial school sector through the lens of relevant official documents and identify relevant contributing factors both on a national Russian scale (e.g., in order to establish the reasons behind the sharp increase in the number of parochial schools in 1883) and on a regional one (e.g., in order to establish the distinctive characteristics of the operation of parochial schools in Ukrainian, Baltic, and Belarusian dioceses).

3. Discussion

To date, the topic under consideration has not been the subject of dedicated research, although attempts to explore the making and development of Russia's parochial school sector have been undertaken more than once. For the most part, researchers have focused either on various landmarks in the history of parochial education on a national Russian scale or on the experience of creating parochial schools in particular regions across the Russian Empire.

The first group of works includes the one by M.A. Goncharov and M.G. Plokhova, which explores the place of parochial schools in the area of training primary school teachers during the imperial period (Goncharov, Plokhova, 2012), the one by V.A. Simora, which examines Russian parochial schools as a phenomenon of religious education that occurred in the period between late 19th and early 20th centuries (Simora, 2009), the one by D.V. Rykhlova, which analyzes the development of the system of public schools in the late 19th century and devotes some attention to parochial and zemstvo schools (Rykhlova, 2018), the one by A.A. Cherkasov, which investigates the system of primary education in Russia in the period of the reign of Emperor Nicholas II and draws conclusions about the effectiveness of that system (Cherkasov, 2011), and the one by the same scholar, A.A. Cherkasov, and his colleagues, which represents a historical-statistical study aimed at establishing the scale of the development of the country's parochial school sector in the period 1860–1917 (Cherkasov et al., 2020). In addition, there have lately been published several historiographical works on the history of parochial schools in Russia. For example, an attempt was undertaken in 2020 by A.S. Bykanov to analyze the Soviet and contemporary historiography on the operation of the parochial school sector in the Russian Empire in the period between the last quarter of the 19th and early 20th centuries (Bykanov, 2020).

The second group of works, concerned with parochial schools in particular regions across the 19th-century Russian Empire, includes the one by V.N. Yakunin, which explores ecclesiastical education and the parochial school sector in the Samara Diocese (Yakunin, 2019), the one by Y.B. Lavitskaya, which explores primary education in the Belarusian lands through the example of church schools (Lavitskaya, 2013), the one by S.Yu. Ierusalimskaya, which examines the development of the parochial school sector in the Upper Volga region (Ierusalimskaya, 2014), the one by T.A. Magsumov and his colleagues, which devotes some attention to parochial schools as part of a study focused on the system of public education in Astrakhan Governorate (Magsumov et al., 2022), the one by G. Rajović and his colleagues, which examines similar processes in Tambov Governorate (Rajović et al., 2023), the one by O.V. Natolochnaya and her colleagues, which examines similar processes in Vilna Governorate (Natolochnaya et al., 2019), and the one by V.S. Molchanova and her colleagues, which examines similar processes in the Kuban region (Molchanova et al., 2019). In addition, of note are the work by A.M. Mamadaliev and his colleagues, which investigates the system of public education in Erivan Governorate, a Transcaucasian region (Mamadaliev et al., 2021), and the one by K.V. Taran and his colleagues, which explores the system of private education in the Caucasus (Taran et al., 2021).

4. Results

Parochial schools were present in Russia from the times of ancient Rus'. While the growth of this sector varied from era to era, parochial schools were indissolubly linked to school education in Russia. In the 19th century, one of the spikes in the development of the country's parochial school sector was witnessed following the abolition of serfdom. Specifically, in 1865 the Russian Empire had over 21,000 parochial schools with a combined enrollment of more than 400,000 students (Pribavlenie..., 1909: 1042). Subsequent to 1865, there was a continual drop in their number. This was associated with the adoption by the Russian government of *Regulation on Primary Public Schools*, of June 14, 1864, as a result of which parochial and Sunday schools were placed under the purview of gubernia and uyezd school councils. Thus, the clergy was no longer in a position to exercise independence of action in the area of school education, which could not but be reflected in the way the country's parochial school sector fared.

It is important to note that during that time the relationship between the country's Orthodox Christian clergy and zemstvos was quite a complicated one. Amongst the zemstvo intelligentsia were many liberals who subjected the clergy to criticism. What was not helping improve this relationship was that at zemstvo primary schools the typical curriculum devoted only 2 hours a week to Religious Education and, on top of that, liberal zemstvo teachers promoted Darwin's theory of human evolution, thus undermining the religious education of students.

By 1882, the Russian Empire had 4,521 parochial schools with a combined enrollment of 115,000 students (Izvlechenie iz vsepoddanneishego otcheta..., 1884: 93) – a 4-times drop relative to 1865. However, the figure varied from region to region across the country. In 1882, Russia had 56 dioceses. The largest number of schools was found in the Kiev Diocese (1,064), followed by the Podolia Diocese (746), the Volyn Diocese (501), and the Riga Diocese (397). The dioceses with the smallest number of schools in 1882 were the Tobolsk Diocese (1), the Caucasus Diocese (1), the Penza Diocese (3), and the Don Diocese (4). In 1866, Russia had fewer dioceses – 54. However, relative to 1865, the number of schools reduced by as many as 2,000 – to 19,400.

Table 1 displays the top four of dioceses in the Russian Empire for the highest number of schools in 1866 and in 1882.

Table 1. Top Four of Dioceses in the Russian Empire for the Highest Number of Schools in 1866 and in 1882 (Izvlechenie iz vsepoddanneishego otcheta..., 1884: 92-93; Izvlechenie iz vsepoddanneishego otcheta..., 1867: 94-95)

Diocese	1866		1882	
	Number of schools	Number of students	Number of schools	Number of students
Kiev	1,349	39,820	1,064	30,097
Podolia	1,164	25,641	746	15,620
Volyn	2,151	20,714	501	11,440
Riga	322	21,255	397	12,254

As evidenced in Table 1, during the period 1866–1882 the numbers of schools and students in the Kiev Diocese each reduced just 25 %. The figures for the Podolia Diocese dropped approximately 40 %. In the Volyn Diocese, the number of schools dropped 4 times and the number of students reduced just 2 times, i.e. there was a sharp increase in the number of students in the sector. Things were the opposite in the Riga Diocese, where the number of schools was up but the number of students reduced almost 2 times, Of note is the fact that in this diocese most of such schools were in lowly populated villages. Of interest is also the fact that the first three dioceses were in modern Ukraine and the fourth was in the modern Baltics. This may be testimony to that in certain Western regions of the Russian Empire there was no pronounced confrontation between the zemstvos and the clergy and the opposing sides were able to find common ground in respect of public education.

Table 2 displays the top four of dioceses in the Russian Empire for the lowest number of schools in 1866 and in 1882.

Table 2. Top Four of Dioceses in the Russian Empire for the Lowest Number of Schools in 1866 and in 1882 (Izvlechenie iz vsepoddanneishego otcheta..., 1884: 92-93; Izvlechenie iz vsepoddanneishego otcheta..., 1867: 94-95)

Diocese	1866		1882	
	Number of schools	Number of students	Number of schools	Number of students
Don	121	2,614	4	120
Penza	167	2,917	3	235
Tobolsk	173	948	1	22
Caucasus	142	2,705	1	36

As evidenced in Table 2, the number of schools in the dioceses with the lowest number of schools in 1882 ranged in 1866 from 121 to 173. That is, in the subsequent 16 years the number of such educational institutions reduced dozens of times, virtually dropping to the initial levels – those the region had when parochial schools first emerged there. Geographically speaking, this group was represented by two dioceses located in central Russia (Penza and Tobolsk Dioceses) and two in southern Russia (Don and Caucasus Dioceses).

Thus, by 1882, the country's 56 dioceses contained a combined 4,521 parochial schools.

Table 3 illustrates the change in the number of parochial schools in the Russia Empire over the subsequent 5 years.

Table 3. Parochial Schools in the Russia Empire in 1882–1886 (Izvlechenie iz vsepoddanneishego otcheta..., 1884: 93; Izvlechenie iz vsepoddanneishego otcheta..., 1885: 93; Vsepoddanneishii otchet..., 1886: 93; Vsepoddanneishii otchet..., 1887: 93; Vsepoddanneishii otchet..., 1888: 94)

Year	Number of schools	Number of students
1882	4,521	115,804
1883	5,942	118,599
1884	4,640	112,114
1885	8,351	202,350
1886	11,693	318,652

When looking at Table 3, we need to take into account the availability of information for different years within the period under consideration. Specifically, in 1884 no data were submitted to the Holy Synod for as many as 10 dioceses – hence the lower number of schools in the table. Nevertheless, it can be seen from Table 3 that in 1883, back before the adoption of *Rules on Parochial Schools*, there was a sharp increase in the number of such schools. This may have been associated with the following two factors: 1) increased demand for primary education (the fewer schools there were in a diocese, the greater was the demand for education); 2) the dioceses must have been aware of the development and discussion of a draft of *Rules on Parochial Schools* and convinced that the regulation would be signed into law. Consequently, the diocesan clergy acted proactively and the number of parochial schools in the Russian Empire immediately increased 25 % (from 4,500 to nearly 6,000), although the number of students remained virtually unchanged.

In 1886, i.e. 2 years after parochial schools were placed again under the purview of the Holy Synod, the situation began to change. Specifically, as evidenced in Table 3, the number of schools increased nearly 2.5 times relative to 1882. However, this growth was uneven.

Table 4 displays the country's top four dioceses with the largest number of schools as at 1882 and includes the dioceses that had over 700 parochial schools in 1886.

Table 4. Dioceses in the Russian Empire With the Largest Number of Schools in 1882 and in 1886 (Izvlechenie iz vsepoddanneishego otcheta..., 1884: 92-93; Vsepoddanneishii otchet..., 1888: 93-94)

Diocese	1882		1886	
	Number of schools	Number of students	Number of schools	Number of students
Kiev	1,064	30,097	1,275	45,240
Podolia	746	15,620	963	27,329
Volyn	501	11,440	472	10,796
Riga	397	12,254	462	17,795
Lithuanian	8	144	792	15,566
Minsk	158	2,336	986	16,770
Mogilev	78	2,907	848	17,923

As evidenced in Table 4, three dioceses in the top four for 1882 posted an increase in the number of schools: the Kiev Diocese – nearly 20 %, the Podolia Diocese – a little over 29 %, and the Riga Diocese – over 16 %. On the other hand, the number of schools in the Volyn Diocese decreased by 29 – and that was despite the legislation being favorable to the clergy. At the same time, three dioceses with more than 700 schools – the Lithuanian, Minsk, and Mogilev Dioceses – established themselves among the leaders. Over the 5-year period, the numbers of schools in the Minsk and Mogilev Dioceses increased 6 and 10 times, respectively. A really unique phenomenon was the increase in the number of schools in the Lithuanian Diocese (from 8 to 792) – an increase of virtually 100 times! It is fair to note that in 1866 the Lithuanian Diocese contained 430 parochial schools – one of the best examples illustrating the collision between the zemstvos and the clergy.

Geographically speaking, the Russian Empire's Western regions – the modern areas of Ukraine, the Baltics, and Belarus – were once again the best performers.

5. Conclusion

The year 1884 was a watershed year for the country's parochial school sector, as that is when the Russian Emperor signed into law the so-called *Rules on Parochial Schools*. This event brought to an end the 18-year period of parochial schools being under the purview of the zemstvos in the Russian Empire, during which this sector had descended into a state of crisis – a 4-times drop in the number of parochial schools in the country relative to 18 years earlier. However, different dioceses in the Russian Empire fared differently during that period. Specifically, the Kiev Diocese lost 25 % of its schools in a 16-year period (from 1,349 schools in 1866 to 1,064 schools in 1882), but the figure was almost restored in the subsequent 5 years (1,275 schools). There was a similar situation in some other Ukrainian dioceses (e.g., the Podolia Diocese). The experience of the Kiev Diocese indicates that the local clergy and zemstvos were able to reach a compromise in the area of public education. A completely opposite example is the case of the Lithuanian Diocese, where the number of parochial schools dropped more than 50 times in the same 16-year period (from 430 to 8) – but then increased nearly 100 times in the subsequent 5 years (from 8 to 792). Thus, the period 1866–1886 was peculiar geographically – the greatest success in preserving the school potential in 1866–1882 was achieved by Ukrainian dioceses, whilst the most dynamic rehabilitation of the parochial school sector in 1882–1886 was exhibited by Baltic and Belarusian dioceses.

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Pedagogical Journals Produced by Educational Institutions in the Russian Empire in the Period 1873–1917

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Abstract

This work examines a set of pedagogical journals published by educational institutions in the Russian Empire in the period 1873–1917.

In terms of the study's sources, use was made of some of the diverse reference literature on the Russian academic periodical press of the imperial period, including the fundamental work by A.V. Mezier, 'A Dictionary Index of Bibliology', L.N. Belyayeva's 'A Bibliography of Periodicals in Russia. 1901–1916', and N.N. Ablov's 'The Pedagogical Periodical Press (1803–1916)'.

The study's findings revealed that the production of academic pedagogical journals by educational institutions was something quite rare in the Russian Empire. Normally, such journals were produced through the efforts of small action groups and academic clubs functioning at educational institutions. In the period from 1873 to 1917, there were at least 14 pedagogical journals published at educational institutions in Russia (7 in Saint Petersburg, 2 in Moscow, 2 in Orenburg, 1 in Nizhny Novgorod, 1 in Chita, and 1 in Kiev). Most of those journals did not last long, with only two of them, *Zapiski Matematicheskogo Kruzhka Pri Orenburgskom Real'nom Uchilishche* and *Vestnik Psikhologii, Kriminal'noy Antropologii i Pedologii*, making it to 5 years. The main reasons behind the closure of the journals were either World War I or the revolutionary events.

Keywords: pedagogical journal, educational institution, Russian Empire, period 1873–1917.

1. Introduction

Pedagogical journals produced by primary, secondary, and higher educational institutions in imperial Russia were a fairly unique phenomenon in Russian academic life. As a reminder, in the 19th century it would take a group of like-minded individuals (e.g., academic societies and

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benefactors) to create an academic pedagogical journal with no government funding. Therefore, such journals normally emerged in the capitals – as major centers of academic life. Starting in the second half of the 19th century, pedagogical journals were also produced at educational institutions in the Russian Empire, which is indication that certain institutions of learning across the country now had teams of like-minded scholars of their own. The present work explores the experience of publishing pedagogical journals at educational institutions in the Russian Empire in the period 1873–1917.

2. Materials and methods

In terms of the study's sources, use was made of some of the diverse reference literature on the Russian academic periodical press of the imperial period, including the fundamental work by A.V. Mezier, 'A Dictionary Index of Bibliology' (Mez'er, 1931), L.N. Belyayeva's 'A Bibliography of Periodicals in Russia. 1901–1916' (Belyaeva, 1958), and N.N. Ablov's 'The Pedagogical Periodical Press (1803–1916)' (Ablov, 1937).

In terms of methodology, use was made of the chronological, statistical, and content-analysis methods. The careful selection and classification of relevant materials helped obtain a comprehensive picture of the production of academic pedagogical journals at educational institutions in the Russian Empire in the period 1873–1917.

3. Discussion

The historiography on this subject is fairly thin. That figures, as there were just a handful of academic journals of this kind, 14 to be exact, most of which lasted very short periods. The subject's historiography may be divided into two groups: 1) publications devoted to pedagogical periodicals produced by secondary and higher educational institutions in Russia and their editors; 2) publications devoted to a different segment of the prerevolutionary pedagogical periodical press.

The first group includes A.V. Ageyeva's 'Organization of the Leisure of Children and Adolescents in Cadet Corps Across the Russian Empire in the Late 19th and Early 20th Centuries (Based on the Materials From the Journal *Voyennaya Byl'*)' (Ageeva, 2015), V.V. Astaf'yev's 'Shelter of Doctor Malyarevsky' (Astaf'ev, 2006), N.M. Novak's 'The Journal *Zapiski Matematicheskogo Kruzhka Pri Orenburgskom Real'nom Uchilishche* as a Reflection of the Level of Mathematical Education in Orenburg Governorate in the Early 20th Century' (Novak, 2011), and I.S. Sidorchuk and Ye.A. Dolgova's 'Facts From the History of One Initiative: A Tribute to the 110th Anniversary of the Launch of *Vestnik Psikhologii, Kriminal'noy Antropologii i Gipnotizma*' (Sidorchuk, Dolgova, 2014). Of note are also the following works devoted to the life and work of D.D. Semenov, the editor of *Pedagogicheskiy Yezhegodnik Kubanskoy Uchitel'skoy Seminarii*: V.V. Makayev's 'The Life and Pedagogical Work of D.D. Semenov' (Makaev, 1956), N.V. Zikeyev's 'D.D. Semenov: Russian Methodologist-Geographer' (Zikeev, 1949), U.P. Oboladze's 'New Facts About the Pedagogical Work of D.D. Semenov in Georgia' (Оболадзе, 1955), and S.V. Izvekova and Yu.V. Kholodkova's 'D.D. Semenov: Russian Pedagogue of the Second Half of the 19th Century' (Izvekova, Kholodkova, 2015).

The second group includes a set of works produced with participation from the author of the present article – more specifically, those focused on the pedagogical periodical presses in the Kiev, Kharkov, and Caucasus Educational Districts (Mamadaliev et al., 2023a; Mamadaliev et al., 2023b; Mamadaliev et al., 2022) and the one covering the pedagogical journals produced by the Russian Empire's highest ecclesiastical body between the late 19th and early 20th centuries (Mamadaliev et al., 2022a).

The present study aimed to fill a research gap in the literature relating to the periodical presses of secondary and higher educational institutions in the Russian Empire.

4. Results

The first pedagogical periodical produced by an educational institution in the Russian Empire was *Pedagogicheskiy Yezhegodnik Kubanskoy Uchitel'skoy Seminarii* (Russian: "Pedagogical Yearly of Kuban Teacher's Seminary"), founded in 1873 and launched in 1874. Its editor was D.D. Semenov, the Seminary's director, and it was published in Saint Petersburg. The yearly was produced by the Kuban Pedagogical Club, headed by D.D. Semenov (Figure 1). The periodical was intended to facilitate information exchange with other teacher's seminaries with a view to improving the quality of education in those educational institutions. It published

materials on organizing the educational process and extracurricular work, and also detailed the scholarly-pedagogical work done by the seminary's instructors over a 3-year period (Izvekova, Kholodkova, 2015: 73). Its first issue carried a number of interesting articles, including D.D. Semenov's 'Teacher's Seminaries in Russia'. Despite the hopes for a long life for it, the production of *Pedagogicheskiy Yezhegodnik Kubanskoy Uchitel'skoy Seminarii* was eventually discontinued, with its first issue being its last.

Fig. 1. Dmitry Dmitriyevich Semenov (1835–1902)

A few words as to the editor of the first-ever publication produced by an educational institution in the Russian Empire. Dmitry Dmitriyevich Semenov was born on January 3, 1835, in Vitebsk Governorate into the family of a teacher of Russian. In 1852, D.D. Semenov graduated from Vitebsk Gymnasium, and in 1859 – from the Saint Petersburg Teacher's Courses. He went on to become a geography teacher. In the 1860s, he taught at a number of gymnasiums. In 1870, he headed up Kuban Teacher's Seminary. In 1878, D.D. Semenov assumed the office of Director of Transcaucasian (Gori) Teacher's Seminary (Oboladze, 1955: 82-86). In 1888–1891, he was the editor of the journal *Detskoye Chteniye*. One of his top works is the geography reader 'Native Land Studies', published in six volumes in the period 1864–1867, which was a mandatory part of the gymnasial curriculum up until 1917 (Zikeev, 1949: 38). D.D. Semenov passed away on March 21, 1902, in Moscow.

The second periodical, *Mediko-Pedagogicheskiy Vestnik* ("Medical-Pedagogical Bulletin"), emerged as early as 1885. A generally accessible academic-literary journal, it, likewise, was published in Saint Petersburg. It focused on issues relating to the education of feeble-minded and defective children. Its editor was physician M.V. Malyarevsky (Astaf'ev, 2006: 126). The journal was published monthly over a 3-year period. The key areas covered in the journal included the following: general and medical issues; hygiene in the family and the school; pedagogical anthropology; observation of phenomena in social life; school organization and management; theory of pedagogy. Famous scholars who contributed to the journal included V.M. Bekhterev, N.P. Wagner, A.Ya. Heard, and M.M. Manàsseina.

The third publication, *Malen'kiy Zhurnal* ("Little Journal"), was a literary, pedagogical, and popular science journal. It was published at Nikolayev Cadet Corps (Saint Petersburg). Its publisher and editor was I.V. Kaznitseyev. The journal was published in the period 1906–1908 (Ageeva, 2015: 38) at a frequency of nine issues per year. It was published with participation from cadets at Nikolayev Cadet Corps, yunkers, officers (former Corps students), and the Corps's pedagogical staff. The journal had the following sections: 1) General Section (mainly fiction); 2) Pedagogy; 3) Study Guides and Learning Resources.

The fourth periodical, *Vestnik Vysshikh Zhenskikh Yuridicheskikh Kursov v Moskve* ("Bulletin of the Higher Women's Legal Courses in Moscow"), was published by S.K. Golitsyna and

V.A. Poltoratskaya. Its editors were Privat Docent V.A. Krasnokutsky and Yu.I. Eichenwald. Published in Moscow in 1907–1908, it came out twice a month. The journal carried a variety of materials – from lecture notes to quizzes and from specialized bibliographies to practical class plans. It also carried materials on the history of the Courses. In 1908, one of the publishers, S.K. Golitsyna, gave up her founding rights to the Courses, and the production of *Vestnik Vysshikh Zhenskikh Yuridicheskikh Kursov v Moskve* was consequently discontinued (Belyaeva, 1958).

In 1907, *Yzhegodnik Orenburgskogo Real'nogo Uchilishcha* ("Yearly of Orenburg Real School") was launched in Orenburg. The periodical lasted 3 years and as many issues (Ablov, 1937: 71).

In 1908, *Yezhegodnik Sankt-Peterburgskogo Vos'miklassnogo Kommercheskogo Uchilishcha v Lesnom* ("Yearly of Saint Petersburg Eight-Grade Commercial School in Lesnoye") was launched in Saint Petersburg. Its editorial team consisted of B.Ye. Raykov, N.M. Sokolov, and the School's director. The periodical was published in 1908, 1910, and 1911. The editors argued in its first issue that Russia had very few general pedagogical journals at the time and that those that were around lacked two-way communication with schools that employed new teaching methods. These ideas formed the actual basis for the production of this periodical, which had two major sections: 1) General Pedagogical Section; 2) Materials Dealing with the Commercial School in Lesnoye. The first issue came out in the form of a general pedagogical journal, with much of its content contributed by the School's instructors (Ezhegodnik..., 1908: 2). The second issue focused on the organization of school trips, and its third – on the use of visual aids in class. Participation from well-known pedagogues earned this periodical a prominent place in the pedagogical literature.

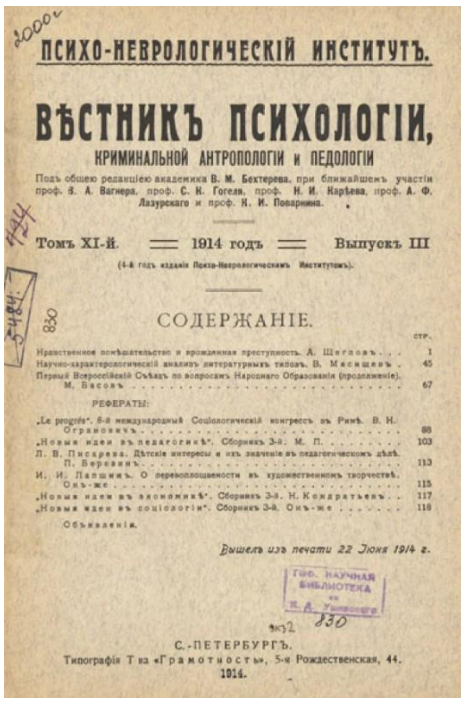
In 1908, the seventh periodical, *Zapiski Matematicheskogo Kruzhka Pri Orenburgskom Real'nom Uchilishche* ("Papers of the Mathematics Club at Orenburg Real School"), was launched in Orenburg. The journal was published from 1908 to 1914. A total of 10 issues were produced. The periodical sought to bring instructors and students together in the area of educational and academic work. Apart from articles on mathematics-related issues, it also carried general pedagogical publications, like those relating to school trips (Novak, 2011: 95-101).

The eighth periodical, *Yezhegodnik Nizhegorodskogo Kommercheskogo Uchilishcha* ("Yearly of Nizhny Novgorod Commercial School"), was launched in 1910. It was published in the period from 1910 to 1915 in Nizhny Novgorod. In that period, six issues of this periodical were produced. It published information about educational work in the School and carried news items relating to student life. It also published certain official materials – such, for instance, as teacher absentee records. In addition, it carried pedagogical articles by members of the School's teaching staff, which included publications on children's reading. It also had a special section, 'Educational Cinema', which covered the work of the Hygiene, Nurturing, and Education Unit within the Nizhny Novgorod Department of Health (lectures, readings, and chats involving watching films) (Ablov, 1937: 83).

The ninth periodical was *Listok Studentov Psikhonevrologov* ("Psychoneurology Student Sheet"), a newspaper for students at the Institute of Psychoneurology. It was published in Saint Petersburg starting in October 1911. Its editors-in-chief in the 1911–1912 and 1912–1913 school years were M. Kostin and G. Malitsky, respectively. The newspaper was a mouthpiece for students and was intended to keep one informed about various aspects of life at the Institute (Mez'er, 1931: 758). It carried materials relating to curriculum design, academic student clubs, and much more.

The 10th periodical, *Vestnik Psikhologii, Kriminal'noy Antropologii i Pedologii* ("Bulletin of Psychology, Criminal Anthropology, and Paedology"), likewise, emerged at the above-mentioned school – the Institute of Psychoneurology in Saint Petersburg (Figure 2). The journal was published under the editorship of V.M. Bekhterev in 1911–1917 at a frequency of five issues per year. It focused on issues relating to psychology, including that of childhood. It devoted some attention to pedagogical psychology and issues relating to pedagogy (Sidorchuk, Dolgova, 2014: 128-137). Prominent scholars who contributed to the journal included A.F. Lazursky, V.A. Wagner, S.K. Gogel, and N.I. Kareyev.

The 11th periodical, *Izvestiya Pedagogicheskogo Instituta Imeni P.G. Shelaputina* ("Bulletin of P.G. Shelaputin Pedagogical Institute"), was launched in 1912. The journal was published in Moscow under the editorship of A.N. Yasinsky, the Institute's director. A total of six issues were published from 1912 to 1916. Apart from official materials, the journal also published articles relating to pedagogy and publications on general issues relating to public education (Belyaeva, 1958). The Institute's pedagogues who contributed to the journal included A.V. Bakushinsky, V. Lysogorsky, and M. Fenomenov.


ПСИХО-НЕВРОЛОГИЧЕСКІЙ ИНСТИТУТЪ.

ВѢСТНИКЪ ПСИХОЛОГІИ,

КРИМИНАЛЬНОЙ АНТРОПОЛОГІИ и ПЕДОЛОГІИ

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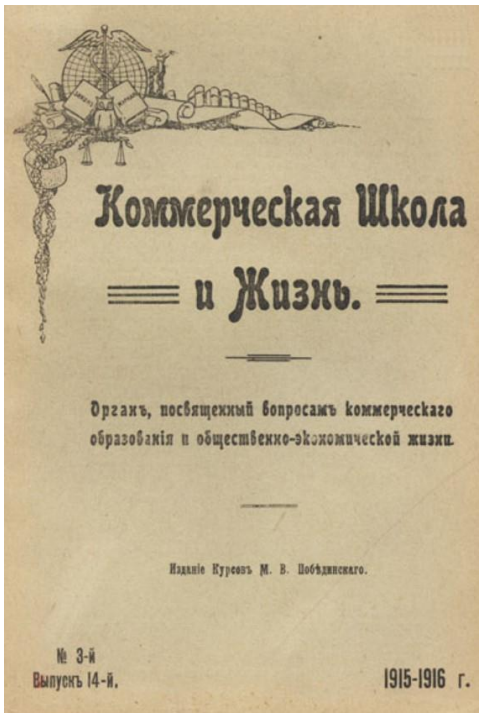
1914.

Fig. 2. Cover page of the journal *Vestnik Psikhologii, Kriminal'noy Antropologii i Pedologii*

The next periodical, *Kommercheskaya Shkola i Zhizn'* ("Commercial School and Life") (Figure 3), emerged in 1913 in Saint Petersburg. It focused on issues relating to commercial education and socio-economic life, with an accounting slant (Bol'shoi bukhgalterskii..., 1999). The journal was produced by the Courses of M.V. Pobedinsky. Its editor was M.V. Bernatsky. It ran until 1917 and had a frequency of four issues per year.


Коммерческая Школа

и Жизнь.

Органъ, посвященный вопросамъ коммерческаго образованія и общественно-экономической жизни.

Изданіе Курсовъ М. В. Побѣдинскаго.

№ 3-й

Выпускъ 14-й.

1915-1916 г.

Fig. 3. Cover of the journal *Kommercheskaya Shkola i Zhizn'*

In 1914, the next periodical, *Letopis' Vechernikh Zhenskikh Kursov* ("Chronicle of the Evening Women's Courses"), was launched in Kiev. The founder of the Evening Women's Courses was A.V. Zhekulina. The journal's editor was Academic Professor V.N. Peretz. Just one issue of this

periodical was produced. The journal was divided into two parts. The first part carried information relating to the Courses, curricula, and teaching plans and covered various educational-pedagogical issues. The second part included works by the institution's students (Ablov, 1937: 99).

In 1915, the 14th periodical, *Voskresnaya Shkola* ("Sunday School"), was launched in Chita. It was the organ of Chita Sunday School. Its editor was N. Krause. The journal was launched in conjunction with the 20th anniversary of Chita Sunday School. Despite the original plan to publish three issues per year, the periodical lasted only one issue. Its first (and only) issue was devoted to the school's anniversary. It carried a review of the school's work, its history, articles by its students, and reminiscences (Mamadaliev et al., 2023: 298).

5. Conclusion

The production of academic pedagogical journals by educational institutions was something quite rare in the Russian Empire. Normally, such journals were produced through the efforts of small action groups and academic clubs functioning at educational institutions. In the period from 1873 to 1917, there were at least 14 pedagogical journals published at educational institutions in Russia (7 in Saint Petersburg, 2 in Moscow, 2 in Orenburg, 1 in Nizhny Novgorod, 1 in Chita, and 1 in Kiev). Most of those journals did not last long, with only two of them, *Zapiski Matematicheskogo Kruzhka Pri Orenburgskom Real'nom Uchilishche* and *Vestnik Psikhologii, Kriminal'noy Antropologii i Pedologii*, making it to 5 years. The main reasons behind the closure of the journals were either World War I or the revolutionary events.

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The Development of Vocational-Technical Education in the Ukrainian Governorates of the Russian Empire in the Late 18th and Early 20th Centuries. Part 2

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Abstract

The work addresses the evolution of vocational-technical education in Ukrainian lands within the Russian Empire. Chronologically, the study covers the period between the late 18th and early 20th centuries.

This is the second part of the work. It continues to explore the development of vocational-technical education in the region and examine the progress in this sector during the period.

The period between the late 19th and early 20th centuries witnessed rapid industrial development across the Russian Empire as a whole and in Ukrainian governorates in particular. This prompted the need to have in place a proper system of vocational training. To this end, the government adopted *Regulation on Industrial Colleges* (1888). Following the launch of this regulation, the areas started to become home to various trade colleges and schools, and their number continually grew on the cusp of the 19th and 20th centuries. Such educational institutions differed in structure, content of education, and organizational practices.

The period under consideration witnessed the development of such areas of vocational-technical education as rail colleges, maritime educational institutions, and technical colleges.

On the eve of the revolutionary events, there was a realization among many of the country's government officials and public figures of the need to reform vocational-technical education. Between 1915 and 1916, a number of draft regulations were proposed regarding technical education, but none were adopted in the end.

While, by and large, vocational-technical education was developing in the Ukrainian areas in the light of the development of vocational education in the Russian Empire, it had distinctive characteristics of its own – most notably, including a focus on meeting the need for workers and

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engineering personnel of the sectors that were dominant in the regions (e.g., maritime transport, foreign commerce, shipbuilding and ship repair, rail transport, agriculture and flour milling, mining and metallurgy, and sugar production).

Keywords: Ukraine, Russian Empire, education, education policy, education reform, economic development, child labor, vocational education, Russian Technical Society.

1. Introduction

In the late 19th century, the Russian Empire embarked on the path of rapid industrialization and industrial modernization. This process was particularly brisk in Ukrainian governorates, involving the creation of new enterprises, modernization of existing operations, attraction of foreign investment, development of technological innovation, and enhancement of labor productivity.

A major role in the production of the necessary workforce for the industrial sector was increasingly played by vocational-technical education. This required a shift from craft-based training of workers to training of a highly skilled workforce for the chemical, mining, shipbuilding, rail, food, and other industries.

Beginning in the 1880s, the government of the Russian Empire put in significant effort into the development of vocational-technical education in the country. This included creating a proper regulatory framework, providing financial assistance, offering scholarships, and improving the material-technical base of educational institutions. These measures helped attract young people to technical specialties and improve the quality of education.

Many of the undertakings attempted during that period that were cut short by World War I and the subsequent revolutionary events require deeper study, with a focus on extracting relevant best practices and employing them in building a robust system of vocational-technical education both in Ukraine and in other states that used to be part of the Russian Empire.

2. Materials and methods

The study relied on relevant research by pedagogical scholars and historians. Use was also made of relevant statutory enactments, namely those from the third part of 'The Complete Collection of Laws of the Russian Empire' (PSZRI-3).

Methodologically, use was made of sets of general and historical research methods. As in the work's first part, the use of induction and deduction helped identify and amass relevant empirical information, which was employed to substantiate the paper's key tenets. The use of analysis and synthesis helped conduct an objective assessment of the various events and processes that had an effect on the making and development of the vocational-technical education in the Russian Empire as a whole and in Ukrainian governorates in particular. The use of the comparative-historical and cliometric methods helped gain an insight into the dynamics and mechanics of the development of the vocational-technical education sector and obtain both national and regional quantitative data for it. It is the use of the cliometric method that helped determine that in the period under consideration the number of vocational-technical educational institutions in Ukrainian governorates accounted for nearly 20 % of all educational institutions of this kind in the Russian Empire.

3. Discussion

Issues related to the development of vocational-technical education in the Russian Empire were explored by contemporaries back in the day. A popular platform for the discussion of the present and future of vocational training in the country was the nationwide pedagogical journal *Tekhnicheskoye Obrazovaniye* (Russian: "Technical Education"; known as *Tekhnicheskoye i Kommercheskoye Obrazovaniye* ("Technical and Commercial Education") since 1908), launched in 1892 by the Permanent Commission for Technical Education. A common view was that it was important to focus on sustained manpower training, and also try to expand the country's network of vocational educational institutions.

The general historiographical picture for the imperial period and the Soviet time was described in sufficient detail in the first part of the work (Trygub et al., 2023: 679-681), so the focus in this part will be on contemporary historiography on the topic. Special attention ought to be paid to the works that provide insight into the study's immediate focus area – the development of vocational-technical education in the Ukrainian governorates of the Russian Empire.

In the early 2000s, Ukrainian historical-pedagogical science exhibited an upsurge of interest in the history of the development of vocational-technical education in the industrialization-era Russian

Empire. Over the last few decades, a number of solid works on the subject have been released, including those by V. Dobrovol′s′ka (Dobrovol′s′ka, 2006; Dobrovol′s′ka, 2021), O. Chornyy (Chornyy, 2007), S. Sytnyakivs′ka (Sytnyakivs′ka, 2009a; Sytnyakivs′ka, 2009b; Sytnyakivs′ka, 2010), Ya. Nahrybel′nyy (Nahrybel′nyy, 2012), M. Honchar (Honchar, 2015), T. Moiseeva (Moiseeva, 2020), I. Petrenko, I. Vynnychenko (Petrenko, Vynnychenko, 2022), A. Lebid, V. Korol, and others (Korol, 2015; Korol, 2017; Degtyarev et al., 2021; Lebid, Shevchenko, 2021; Lebid, 2022; Lebid, Lobko, 2022), which provide insight into various aspects of the development of vocational-technical education in the Russian Empire as a whole and in Ukrainian governorates in particular.

Most of this research is represented by dissertation-based works with a narrow problem or geographical focus. For instance, the work by V. Dobrovol′s′ka (Dobrovol′s′ka, 2006) explores the history of female education in Southern Ukraine. It touches upon vocational-technical education through the lens of the post-and-telegraph courses offered at the urban six-grade college in Odessa and the mixed dental schools of G. Balaban and M. Bank, likewise, in Odessa.

The development of pre-Soviet nautical education in Southern Ukraine is explored in the dissertation by O. Chornyy (Chornyy, 2007). The work provides an insight into the preconditions for the emergence of nautical educational institutions in the Black Sea region, offers a theoretical summarization of the operation of the system of educational institutions under the purview of the highest maritime authority, including an insight into the way they were managed and funded, and discusses the role of maritime schools in Southern Ukraine in providing the Black Sea fleet and private nautical societies and companies with qualified specialists.

The works by S. Sytnyakivs′ka (Sytnyakivs′ka, 2009a; Sytnyakivs′ka, 2009b) explore the development of trade education in Ukrainian governorates. This research represents one of the few attempts to investigate the subject under consideration in a historical-pedagogical, as opposed to purely historical, context. Consequently, the researcher not only provides insight into the key factors, trends, and stages in the development of trade education in Ukraine in the second half of the 19th and early 20th centuries but also offers an analysis of the theoretical foundations of the issue of the development of trade education in classical domestic and foreign pedagogical theories and historical world practice, discusses the mechanics of the organization of the educational process at trade educational institutions in Ukraine, and describes the key characteristics of the content of such education and instructional support for students' learning process.

The development of vocational education in Kherson Governorate is explored in the dissertation-based works by Ya. Nahrybel′nyy and M. Honchar. The one by Ya. Nahrybel′nyy (Nahrybel′nyy, 2012) discusses the place of vocational education in the Russian Empire's education system in the second half of the 19th and early 20th centuries and provides an insight into the development of educational institutions of an agrarian, pedagogical, medical, commercial, and maritime character in that region. At the same time, the work does not cover the pedagogical context of the educational process and provides no insight into the mechanics of the operation of such educational institutions and related characteristics.

The work by M. Honchar (Honchar, 2015) explores the development of lower vocational education in Southern Ukraine in the second half of the 19th and early 20th centuries. The author makes use of a large body of factual material to analyze the development of the system of vocational training in that period, brings forward a periodization of his own devising, fine-tunes the meaning of the term 'lower vocational education', and proposes a model for the use of the study's findings in reforming the system of vocational training of youth.

There has been an increase within historical-pedagogical science in interest in exploring vocational-technical education in the Russian Empire through the prism of regional science. However, there remains a lack of research focusing on the pedagogical component of the educational process, the role of the Russian Technical Society, and particular areas of vocational-technical education (e.g., shipbuilding and the food industry) in Ukrainian governorates specifically.

4. Results

In the early 1880s, the Russian Empire was faced with an acute need for a robust system of vocational training, with an added focus on the vocational-technical component. The development of specialized education required uniformity in terms of the organization and content of the educational process in vocational schools.

In 1878, this task was entrusted to the Ministry of Finance. In 1881, the country's vocational-technical institutions were placed under the purview of the Ministry of Public Education. In 1883,

a special department was set up at the Ministry of Public Education concerned with the management of the vocational education sector, including the opening of new educational institutions, designing of curricula, and approving of programs of study (Kuz'min, 1971: 17). In addition, some of the vocational-technical institutions were run by specialized government agencies, such as the Ministry of Communication Lines (technical rail colleges) and the Ministry of Finance (nautical schools).

The 1880s witnessed the building of a more or less harmonious system of vocational-technical education in the Russian Empire, and that would have an effect on this type of education in the Ukrainian lands as well. Special regulations were developed for particular vocational-technical institutions. The first regulation of this kind, *Regulation on Technical Rail Colleges Under the Purview of the Ministry of Communication Lines*, was released on April 7, 1886 (PSZRI-3. T.VI. №3611: 143-147) (amended on December 26, 1888, April 8, 1891, and February 28, 1894) (PSZRI-3. T.VIII. №5671: 635; PSZRI-3. T.XI. №7610: 166; PSZRI-3. T.XIV. №10391: 90-91), resulting in the establishment within the Ministry of Communication Lines of a department that would oversee all of the country's rail schools.

Pursuant to the above regulation, the objective for technical rail colleges was to educate primarily the children of rail workers (e.g., train operators and conductors). A college's first grade enrolled children aged 14 to 18 years who had graduated from a two-grade rural, uyezd, or urban college or a two-grade parochial school. In addition, it would also admit home-educated children who had successfully passed the entrance examination. The program of study was 3 years long. Upon completion of this program, students would undergo two years' practical training. There was an accepted practice of a class in the last year being split into sections based on area of specialization.

The average curriculum included about 20 core subjects. In addition to a set of general subjects (e.g., religious education, singing, and gymnastics), instruction was also provided in a number of disciplines crucial to future rail workers mastering certain practical skills (e.g., mathematics (inclusive of practical accounting and surveying), general physics, practical telegraphy, mechanics, a brief course in woodworking and metalworking, practical railroading, drafting, whitesmithing, blacksmithing, and joinery). Upon completion of the program of study, most graduates would be employed in the field of rail transport.

Each rail college had a pedagogical assembly headed by the head of the school and a facilities committee headed by the trustee, who was elected by the board of the Railroader's Society. Such colleges had training shops at them, and some had a preparatory grade catering to children of rail workers exclusively. This sector developed at a very fast pace, and over a period of 30 years (1869–1898) it produced 7,747 graduates across the Russian Empire (Uchilishcha zheleznodorozhnyye, 1902: 119). Many schools of this kind were established across Ukraine (e.g., in Odessa, Kharkov, Kiev, Nikolayev, and Yekaterinoslav).

The next statute crucial to the organization of the system of vocational-technical education was *Regulation on Industrial Colleges*, adopted on March 7, 1888 (PSZRI-3. T.VIII. №5057: 78-83). It was founded on 'A General Normal Plan for Industrial Education in Russia', developed by I.A. Vyshnegradsky, a well-known Russian scholar (Kuz'min, 1971: 18). The statute set out the following three categories of vocational-educational institutions: 1) secondary technical schools with a 4-year program of study (graduates of such schools would be conferred with the degree of Technician), which enrolled learners who had completed five grades at a real college; 2) lower technical schools with a 3-year program of study, which enrolled learners who had graduated from an urban school; 3) trade schools with a 3-year program of study, which enrolled learners who had graduated from a primary school.

The emergence of this document marked the beginning of a new stage in the development of vocational education in the Russian Empire. The plan for industrial education provided a set of key avenues for training skilled workers, foremen, and technicians. A set of regulations were put in place determining the place of vocational-technical educational institutions in the overall system of public education. Standard curricula were developed for each type of such educational institutions. The problem with the design of curricula for such schools was that it undermined continuity in teaching general subjects at lower technical colleges and general-education schools. This made it harder for graduates of vocational-technical educational institutions to continue their education at an educational institution of a different type.

The emergence of a document systematizing vocational-technical education in the country was a positive phenomenon. It was expected that the pace of the development of vocational

education and creation of an extensive network of educational institutions capable of training the required number of professionals for employment in industry, transport, agriculture, and commerce would increase substantially. However, in contradiction to the objective laws governing the country's economic development, the policy pursued by the tsarist government in the area of public education was artificially inhibiting the process of bourgeois-democratic transformations. There were still remnants of the social stratification system in the public education sector. In that climate, despite the natural need for radical improvements in training of professionals for industry, agriculture, and commerce, it was difficult to implement the plan for industrial education in Russia in an appropriate manner (Kuz'min, 1971: 18-21).

During that period, the Ukrainian areas started to become home to various trade colleges and schools, and their number continually grew on the cusp of the 19th and 20th centuries. Specifically, as at 1911, the Kiev Educational District had 18 trade colleges and schools across the five governorates: four trade colleges (Kiev Alexander Trade College (est. 1874); Poltava Trade College (1878); Chernigov Alexander Trade College (1888); Privy Councilor M.A. Tereshchenko Glukhov Trade College (1899)) and 14 trade schools (Klintsy Secondary Seven-Grade Technical School-Based Lower Trade School (1895); Chernobyl Lower Trade School (1899); Mrin Lower Trade School (1900); Oster Lower Trade School (1901); Kagarlyk Lower Trade School (1902); Kiev Lower Trade School (1902); Berdichev School for Trade Learners (1903); Bratslav Lower Trade School (1907); M.S. Ivanina Chebotarka Lower Trade School (1907); Baron P.P. Mestmacher Novaya Ushitsa Lower Trade School (1908); Krolevets Lower Trade School (1909); Kamenets-Podolsky Lower Trade School (1910); Zhitomir Lower Trade School (1911); Cherkassy Lower Trade School (1911)).

In the Odessa Educational District, the city of Odessa alone had 33 trade schools during that period, with a combined enrollment of 2,300 students. The governorates that were part of this district had more than 80 such schools combined (e.g., Odessa Main Trade College of Horticulture (1847); Odessa Female Trade Jewish College (1860); Odessa Trade College of the Trud Society (1864); Odessa Urban Female Trade College (1882); Simferopol Trade College (1884); Anan'yev Trade College (1891); Odessa Urban Trade College (1891); Bakhmut Trade College (1896); Odessa Orphanage-Based Trade College (1908); Uyezd College-Based Akkerman Trade School (1868); Odessa Trade School (1871); Anan'yev School for Trade Learners (1887); Stary Krym Trade School (1893); Odessa Trade School of Printing (1900); Autka Lower Trade School (1904); Yekaterinoslav School of Ceramics (1905); Bobrinsk Lower Trade School (1905); Berezovka Lower Trade School (1905); Stepanovka Lower Trade School (1905); Rezinsk Lower Trade School (1906); Lieutenant General P.K. Men'kov Sevastopol Lower Trade School (1908); Man'kovo-Kalitvenskoye Lower Trade School (1908) (Sytnyakivs'ka, 2009a: 96-98)).

Sometimes, trade education was provided via special courses at technical and other types of industrial educational institutions. Specifically, in 1900, Odessa Alexander Urban Four-Grade College began to provide evening courses in technical drafting and drawing for tradesmen and workers. This was funded through donations from local factory and mill owners. A distinctive characteristic was that these courses were attended by adults (workers and foremen from industrial enterprises), which was associated with the need to learn new production processes and required additional vocational-technical education.

Trade educational institutions differed in structure, content of education, and organizational practices. Different trade colleges and schools provided instruction in different crafts. For example, the educational institution in Kiev provided instruction in whitesmithing, blacksmithing, joinery, turnery, carving, and shoemaking, the one in Chernigov – whitesmithing, turnery, and foundry, the one in Poltava – whitesmithing-turnery, blacksmithing, foundry, and joinery-patternmaking-carving, the one in Glukhov – whitesmithing-blacksmithing and joinery-patternmaking, the overwhelming majority of the region's lower trade school – whitesmithing-blacksmithing and joinery-turnery, and the school in Krolevets – whitesmithing-blacksmithing, joinery-turnery, and weaving (Sytnyakivs'ka, 2009a: 102-103).

Thus, lower vocational-technical educational institutions (trade colleges and schools) typically prepared students for narrow trade professions and were of a homogeneous nature in terms of subject matter.

Another sector whose organization was formalized statutorily was maritime vocational-technical educational institutions. In 1902, the government adopted *Regulation on Nautical Educational Institutions* (PSZRI-3. T.XXII. №21413: 322-328). Per this regulation, nautical educational institutions were divided into four classes. *Colleges of deep-sea and coastal navigation*

trained Grade 1 and 2 ship drivers (for steam vessels). The Grade 1 and Grade 3 ship driver programs were 3 years and 2 years long, respectively. *Nautical schools* trained Grade 3 and 4 ship drivers (for sailing vessels) and were three-grade and two-grade, respectively. There also were *preparatory nautical schools*, which were equivalent in program length (3 years) to urban colleges and could open as standalone educational institutions or in tandem with other nautical educational institutions. In addition, there were *nautical knowledge courses*, designed to provide merchant seamen with the necessary knowledge in particular subjects or groups of subjects. Colleges of deep-sea and coastal navigation enrolled 15-year-olds who had graduated from a preparatory nautical school or an urban college and had at least 2 months' sailing experience. Nautical schools enrolled individuals at least 17 years of age who had completed primary school and had 12 months' sailing experience. Preparatory nautical schools enrolled individuals aged 13 to 17 years who could read and write and knew the four basic arithmetic operations. Graduates of colleges of deep-sea and coastal navigation and nautical schools would be eligible for trials, completing which would get one the degree of Ship Driver.

Pursuant to the 1902 regulation, the degree of Ship Driver was divided into two levels (Captain and Steersman), each of which was divided into four grades (depending on navigation being deep-sea and coastal and vessels being steam and sailing). To get one's Ship Driver diploma, one would also have to complete an exam to a special panel.

The theoretical education required in order to fulfill the duties of a steersman was considered sufficient for a captain too, with the degree of Captain conferred upon a steersman upon receipt of a special navigation qualification. To acquire the lowest (fourth) grade, one would have to pass exams in the following subjects: principal laws on merchant shipping, navigation, nautical astronomy, rules for preventing collisions at sea, ship rigging, barometer use, and English. To be eligible for the highest (first) grade, one would have to have sailing experience and knowledge of ship mechanics, ship hygiene, commercial correspondence, and geography.

The day-to-day management of a nautical educational institution was conducted by its principal and board of trustees. Such schools were normally established and run through port dues and other forms of state funding, as well as funding from non-governmental and estate institutions and individual persons. Tuition fees and donations formed a college's special budget to be spent on extra-budgetary purposes exclusively.

The transformation of nautical classes based on the 1902 regulation was a gradual process. It was completed by July 1, 1905. A portion of nautical classes were discontinued, including those offered in the inner governorates of the Russian Empire. As at January 1, 1906, there were 34 nautical educational institutions: 7 colleges of deep-sea navigation, 2 colleges of coastal navigation, 7 three-grade maritime schools, 11 two-grade maritime schools, 5 preparatory maritime schools running in tandem with other nautical schools, and 2 colleges with a broader program and of a somewhat different type (Odessa College of Merchant Shipping, established in 1898 and transformed in 1901 to offer ship driving and engineering courses, and Arkhangelsk Merchant-Nautical College, established in 1899).

Fourteen of the educational institutions trained personnel for working in the Baltic Sea, 8 – in the Black Sea, 5 – in the Sea of Azov, 4 – in the White Sea, 2 – in the Caspian Sea, and 1 – in the Pacific Ocean.

At year-end 1903, the funding allocated toward the upkeep of nautical educational institutions in the country amounted to 306,000 rubles, of which 252,000 rubles (80%) came from port dues and other forms of state funding and 54,000 rubles (20%) came from subsidies from local communities and other sources (with the exception of tuition fees). As at 1903, the country's 36 nautical educational institutions had a combined enrollment of 1,974 (Morekhodnoye obrazovaniye, 1906: 208).

On June 10, 1903, the government adopted *Regulation on Engineers on Nautical Vessels in the Merchant Marine* (PSZRI-3. T.XXIII. №23125: 738-741) (effective only in 1908), which established three grades of the degree of Ship Engineer (depending on the characteristics of steam vessels). To be eligible for the award of a diploma of Grade 3 and 2 Ship Engineer, one would have to pass a theoretical exam and have a reasonable amount of practical experience (24–36 months' sailing experience for Grade 3 and 36 for Grade 2). To qualify for the award of a diploma of Grade 1 Ship Engineer, one would just have to have some practical experience (24–36 months). In order to acquire a Grade 2 or 1 diploma, one would have to be a holder of a lower level diploma. Individuals with a higher or secondary education in an engineering specialism would be exempt from a theoretical exam and the required amount of practical experience would be reduced by two-thirds

for the former and by half for the latter. Exams for the degree of Grade 3 Ship Engineer would be sat in Russian, mathematics, theoretical mechanics, ship mechanics, and shipbuilding. Exams for the degree of Grade 2 Ship Engineer would be sat in the same subjects, except that there was electrical illumination instead of shipbuilding.

Apart from the above-mentioned types of nautical vocational-technical educational institutions, there also were colleges and schools for training ship engineers. The corresponding regulation was adopted on June 13, 1905 (PSZRI-3. T.XXVI. №26420: 508-513). Pursuant to this regulation, for the purposes of training ship engineers in the merchant marine, it would be permitted to establish colleges for ship engineers and courses in an engineering specialism in the merchant marine. Such educational institutions could be opened as standalone ones or in tandem with other educational institutions of a different class with the same focus or with colleges of deep-sea navigation.

Colleges for ship engineers provided theoretical and practical training to Grade 2 engineers and consisted of four grades – the preparatory grade and three specialized grades. S*chools for ship engineers* provided theoretical training to Grade 3 engineers in the preparatory and two specialized grades. There could also be an additional grade in place to train Grade 3 ship engineers to enable them to upgrade to the Grade 2 level.

Both types of educational institution provided instruction in the following subjects: religious education, Russian, mathematics, physics, chemistry, theoretical and practical engineering, strength of materials, ship mechanics, ship equipment, ship theory, English, drafting, special laws on merchant shipping, and first aid treatment for emergencies.

At the same time, the curriculum of such colleges also included heat, materials science, marine engine and boiler damage description and shipboard repair, and naval electrical engineering (as opposed to electrical illumination at such schools).

Courses in an engineering specialism in the merchant marine were concerned with the provision of applied and specialized knowledge of engineering in the merchant marine. A college for ship engineers would enroll 15-year-olds who had completed a preparatory nautical school or an urban college and had at least 2 months' sailing experience. A school for ship engineers would enroll 16-year-olds who had completed a full course of study in primary school and met the practical experience requirements for receipt of the Grade 3 Engineer degree. As at January 1, 1906, the Ukrainian region had two educational institutions for training ship engineers – School for Ship Engineers in Sevastopol and the Engineering Department at Odessa College of Merchant Shipping, which had a 3-year program of study (Morekhodnoye obrazovaniye, 1906: 209).

In conclusion, a few words as to the creation of a system of higher technical education in the country. Higher technical educational institutions were to produce skilled engineers-in-charge for technical and industrial enterprises and prepare personnel who would be employed as administrative staff and faculty members at technical educational institutions. A person could enroll in a higher technical educational institution if they had a secondary general education. Along with the necessary practical knowledge, each higher technical educational institution would provide one with relevant elements of higher general education. Consequently, the length of study at such an institution could be a year more than what was offered at universities, where it was 4 years.

In the early 20th century, three of the Russian Empire's 14 higher technical colleges were in operation in Ukrainian governorates: 1) Kharkov Practical Technological Institute of Emperor Alexander III (est. 1885), comprised of two departments (Engineering and Chemistry), which had a 5-year program of study; 2) Yekaterinoslav Higher Mining College (1899), comprised of two departments (Mining and Metallurgy); 3) Kiev Polytechnic Institute of Emperor Alexander II (1898), established for the purposes of training skilled technician-engineers in various specialisms. As at the start of the 20th century, the institute in Kiev had four departments, all of which matched the more developed sectors of industry in Ukraine's Dnieper region: Chemistry, Mechanics, Engineering, and Agriculture. The program of study was 4 years long. It was at the time the largest technical college in the Ukrainian lands. Established mainly on donations from proprietors of large commercial-industrial capital, it, however, operated with state funding (Tekhnicheskoye obrazovaniye, 1901: 127-128).

In the late 1890s, the Russian Empire witnessed the dynamic creation of large industrial associations and an increase in the number of enterprises. Amid stiffening competition in the world market, issues of labor productivity, production practices, and technical literacy were becoming a particularly pressing concern. There was a significant shortage of trained specialists and skilled technical operations managers within Russian industry, which could not but hinder the country's industrial development.

Thanks to its geographical location and natural resources, Ukraine was at the start of the 20th century among the more industrially developed regions of the Russian Empire. A distinctive characteristic of Ukraine's process of industrial growth was uneven regional development, which led to its industrial regions developing a particular specialization, with the Donbas becoming the center of the coal industry, the Nikopol Basin – the manganese industry, Krivoy Rog – the iron ore industry, Right-Bank and a portion of Left-Bank Ukraine – the sugar industry, Yekaterinoslav – metallurgy, Kharkov and Lugansk – machinery manufacturing and locomotive manufacturing, and Nikolayev – shipbuilding and Odessa ranking in the top three of the Russian Empire's ports in volume of marine trade and first in the Azov-Black Sea basin. Consequently, there was increased demand for professional workers, but the transformations also shaped the regional specialization of vocational-technical education in the Ukrainian lands.

In the early 20th century, the Permanent Commission for Technical Education, a body within the Russian Technical Society, performed an examination of the country's vocational-technical education sector. At that time, the country had 1,423 trade schools, colleges, and training shops, with a combined enrollment of nearly 80,000 students. However, the vocational education sector was in need of major structural change. To this end, members of the Commission proposed using the following system of trade and vocational education in the Russian Empire:

– combination of vocational and general schooling;

– specialized vocational schooling;

– educational workshops for children, adolescents, and adults;

– mobile workshops, courses, specialized instructors for particular crafts, technical brochures, etc.;

– manual training in primary school and provision of specialized knowledge in comprehensive school (Sytnyakivs'ka, 2009a: 70).

In May 1915, the government appointed Count P.N. Ignat'yev (1870–1945) Minister of Public Education. Under P.N. Ignat'yev, the Ministry was preparing to reform the country's school sector as a whole and the vocational education sector in particular. As one of the first steps in this direction, P.N. Ignat'yev convened in February 1915 a meeting with educational district trustees. Apart from issues related to reform of the country's general-education system, the meeting also discussed the future development of vocational education. In the February 24 sitting, the need was recognized to further develop the industrial education sector. Meeting participants discussed the need to enhance the content of vocational education at all levels. It was also acknowledged that it was advisable to spread this type of education amongst women.

Following the meeting, the Ministry of Public Education started work on a draft law on vocational education in the country. Concurrently, issues relating to reform of specialized school were also considered by a few other government agencies. To ensure uniformity and consistency in tackling challenges in vocational education, a special interagency council, headed by P.N. Ignat'yev, was set up in August 1915 to handle vocational education and work on legislation in this area. The Council was membered by officials from all Ministries that had vocational educational institutions under their purview. On August 10, 11, and 17, 1915, the Council discussed the following major issues related to vocational-technical school: ways to spread vocational knowledge; correlation between the systems of general and vocational education; types of specialized educational institutions, classes, and courses; content of specialized education and the rights of graduates of specialized educational institutions; coordination of work between the different entities involved in the process of development of the specialized education sector (Kuz'min, 1971: 32-33).

Of particular note in the context of this study is the draft of the *Regulation on Vocational Educational Institutions, Classes, Courses, and Educational Institutions Under the Purview of the Ministry of Public Education*, which envisioned having in place by 1915 "a single system of vocational-technical education comprised of four types of educational institution: 1) higher technical educational institutions; 2) technical colleges for training technicians via a higher primary college; 3) trade colleges for training foremen and skilled workers via a two-grade rural school; 4) colleges for training skilled workers via a primary college" (Polezhay, 2011: 91; Kuz'min, 1971: 34).

The draft regulation gave special consideration to implementing training in trades at general-education schools. It envisioned introducing specialized classes and vocational-technical courses.

Similar ideas were presented in the draft of the *Regulation on Technical Educational Institutions and on Institutions Concerned With Spreading Technical Knowledge Under the Purview of the Ministry of Commerce and Industry* (1915). This document envisioned having in

place a system of training junior- and mid-level specialists comprised of the following: 1) courses and schools for training workers; 2) courses for training leadmen; 3) courses and schools for training foremen; 4) technical courses; 5) technical colleges (Kuz'min, 1971: 34). The 1915 draft regulation was aimed at significantly simplifying the actual procedure for establishing trade schools, which would make it possible for them to be set up by private individuals, non-governmental organizations, other educational institutions, and enterprises.

A characteristic common to the above draft regulations was the increased focus on opening more vocational educational institutions and optimizing the operation of such schools (Sytnyakivs'ka, 2009a: 72).

However, the reforms proposed under P.N. Ignat'yev would meet the same fate as many other transformations undertaken in the early 20th century. As early as March 15, 1916, the Empress wrote the following in a letter to Nicholas II: "I would like to have an opportunity to put a stop to Ignat'yev's liberal speeches in the Duma in which he proposes opening up universities and so on throughout Russia" (Polezhay, 2011: 93). On December 27, 1916, P.N. Ignat'yev was dismissed from his post, with M.K. Kul'chitsky taking over.

Despite the pursuit of such an inconsistent policy in the area of vocational-technical education, the number of such educational institutions continually grew in the Russian Empire. As at the start of 1917, there were a combined 3,532 secondary and lower vocational-technical educational institutions in the country. This figure, however, included demonstration training shops (688) and factories (24). We should also exclude from that trade classes and manual training classes at general-education schools, which do not qualify as a specialized educational institution, as well as commercial colleges, which were secondary general-education schools (Kuz'min, 1971: 36). Thus, there were around 2,500 specialized educational institutions in the Russian Empire at the time. At the same time, Ukraine had around 498 vocational institutions (Siropolko, 2001: 442) (Table 1), which accounted for nearly 20 % of all educational institutions of this kind in the Russian Empire.

Table 1. Numbers of Secondary and Lower Vocational Schools in the Ukrainian Lands as at the Beginning of 1917

Secondary schools		Lower schools	
Agricultural	6	Trade	25
Technical	10	Agricultural	4
Fine arts	11	Industrial-technical	44
		Commercial-industrial	1
		Feldsher and obstetrical-feldsher	6
		Fine arts	1
Total	27	Total	71

5. Conclusion

The making of vocational-technical education in the Ukrainian lands was facilitated at the time by a number of socio-economic and socio-cultural preconditions. Vocational-technical educational institutions were a special category in the Russian Empire, and there were 12 groups of them there in the second half of the 19th century: ecclesiastical, pedagogical, medical, legal, military, maritime, surveying, topographical, arable farming, forest and agricultural, technical and trade, commercial, Oriental language, and art. Technical and trade educational institutions were divided into the following three subgroups – (1) higher (higher technical educational institutions), (2) secondary (industrial and higher technical colleges), and (3) lower (lower technical colleges, normal-type trade colleges, industrial schools operating per a special charter, technical rail colleges, and rural trade training shops).

Under pressure from the public and in view of a set of objective economic factors, the government realized the need to build a proper system of vocational-technical education in the country. A foundational step in this process was the launch on March 7, 1888, of *Principal Regulations on Industrial Colleges*, which set out key principles to guide the development of technical education in the Russian Empire. Consequently, the general approach to training vocational-technical personnel in Ukrainian governorates would not be much different to the way

the educational process was organized and managed across the Russian Empire as a whole.

A special type of vocational-technical educational institutions was rail colleges and nautical educational institutions. Rail colleges were concerned with training specialists for the building of railroads and the operation of rail transport. Nautical schools were focused on training mariners and maritime technicians, the need for which was driven by the emergence of steamships, which were supplanting the sailing fleet. A typical program of study was designed in such a way as to provide students with a sufficient amount of general-education and technical training and help them acquire an appropriate amount of specialized knowledge.

While, by and large, vocational-technical education was developing in the Ukrainian areas in the light of the development of vocational education in the Russian Empire, it had distinctive characteristics of its own – most notably, including a focus on meeting the need for workers and engineering personnel of the sectors that were dominant in the regions (e.g., maritime transport, foreign commerce, shipbuilding and ship repair, rail transport, agriculture and flour milling, mining and metallurgy, and sugar production). That said, despite positive shifts in the development of vocational-technical education, the system could not meet all of the demand for this type of education amid the rapid development of capitalism on the cusp of the 19th and 20th centuries. This, most notably, was associated with reasons such as a lack of attention to the issue on the part of central and local authorities, a high level of centralization of authority over education, and insufficient funding.

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Yearly Publications Produced by the Arkhangelsk Gubernia Statistics Committee as a Source on Socio-Economic Development of the Arkhangelsk Governorate in early 20th century

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Abstract

This work examines a set of yearly publications produced by the Arkhangelsk Gubernia Statistics Committee. These publications could be drawn upon for insight into socio-economic development in early 20th century Arkhangelsk Governorate.

The principal sources for this study are a set of yearly publications produced by the Arkhangelsk Gubernia Statistics Committee in the early 20th century, namely a set of memorandum books and address calendars for Arkhangelsk Governorate and 'Arkhangelsk Governorate Overview for 1911'.

The study's findings revealed that the production of yearly publications by the Arkhangelsk Gubernia Statistics Committee in the early 20th century was characterized by impermanence. In 1901–1904 the Committee published address calendars, in 1905 – a directory, in 1906 – another address calendar, and in 1907–1916 – memorandum books for Arkhangelsk Governorate. In addition, in 1912 the Committee released what would be a one-off – 'Arkhangelsk Governorate Overview for 2011'.

When the publication of memorandum books for Arkhangelsk Governorate commenced, there began to be published scholarly articles devoted to socio-economic development in the region. Most of those publications were prepared by staff members of the Arkhangelsk Gubernia Statistics Committee, who also held responsibility for the quality of other materials that were published by it. As was the case in most regions across the country, the production of yearly

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publications by the Arkhangelsk Gubernia Statistics Committee was cut short by the events of 1917 and the collapse of the Russian Empire.

Keywords: socio-economic development, Arkhangelsk Governorate, Russian Empire, sustainable regional development, early 20th century, yearly publications, Statistics Committee.

1. Introduction

Socio-economic development in regions across the Russian Empire was covered in a large number of historical sources of the imperial period. These include archival documents, sources of private origin (diaries, letters, and recollections), collections of published documents, and prerevolutionary periodical press materials. Among the periodicals, of particular note are memorandum books, address calendars, and governorate overviews published by regional statistics committees. This paper will examine this type of yearly publications through the example of early 20th century Arkhangelsk Governorate.

2. Materials and methods

The principal sources for this study are a set of yearly publications produced by the Arkhangelsk Gubernia Statistics Committee in the early 20th century, namely a set of memorandum books and address calendars for Arkhangelsk Governorate and 'Arkhangelsk Governorate Overview for 1911'.

In conducting source studies research, of particular importance is validation of the historical documents. Internal criticism enables the researcher to identify worthwhile sources and perform a factual analysis thereof. With this in mind, the present study was focused exclusively on the yearly publications prepared for production by the Arkhangelsk Gubernia Statistics Committee. The use of the historical-chronological method helped explore these yearly publications retrospectively and identify their key distinctive characteristics.

3. Discussion

In terms of the topic's historiography, it is worth noting that letters, personal accounts, and the periodical press have been drawn upon as sources for the study of Arkhangelsk Governorate more than once.

Specifically, M.A. Smirnova considers the newspaper *Arkhangel'skiye Gubernskiye Vedomosti* (Russian: "Arkhangelsk Gubernia Gazette") as a historical source for genealogical research (Smirnova, 2003), and O.N. Bolgova addresses forest management in Arkhangelsk Governorate based on materials from *Lesnoy Zhurnal* ("Journal of Forestry") (Bolgova, 2013).

T.G. Ivanova examines the early testimonies to the existence of epic poems in Arkhangelsk Governorate found in writings by a number of Russian folklorists (Ivanova, 2016), and G.G. Kotsur addresses the life and work of M.A. Kolchin, the first chronicler of the history of the Solovetsky prison (Kotsur, 2013).

In terms of the use of letters as a source of private origin, D.I. Il'chuk addresses the daily life of political exiles in the town of Mezen', Arkhangelsk Governorate, based on letters from I.F. Armand (Il'chuk, 2016), and R.A. Davydov examines letters from peasants and officials in the governorate petitioning for a curtailment of the application of the Hunting Act of 1892 (Davydov, 2019).

4. Results

The set of historical sources covering socio-economic development in early 20th century Arkhangelsk Governorate comprises several yearly publications produced by the Arkhangelsk Gubernia Statistics Committee.

Every year, the Arkhangelsk Gubernia Statistics Committee produced literature aimed at providing relevant information on the region's public authorities and their officers. By tradition, such literature was represented in the Russian Empire by address calendars. However, things were somewhat different in Arkhangelsk Governorate. In 1901–1904 it was address calendars, in 1905 – a directory of officials in Arkhangelsk Governorate, in 1906 – another address calendar for Arkhangelsk Governorate, and in 1907–1916 – a memorandum book for Arkhangelsk Governorate.

When it comes to internal criticism of this source, it is worth noting that at the beginning of the period under review the address calendar carried information regarding the composition of the officialdom in Arkhangelsk Governorate. These lists started with the Ministry of Internal Affairs,

beginning with the post of Governor and ending with the officers of the Arkhangelsk Department of the Moscow–Arkhangelsk Rail Gendarme Police Department. This was followed by the officers of the following organizations: Ministry of Finance, Ministry of Arable Farming and State Property, Ministry of Justice, Ministry of State Control, Ministry of Public Education, Ministry of Communication Lines, Office of the Institutions of Empress Maria, Ministry of War, Maritime Ministry, and Office of the Orthodox Confession. This was followed by urban and uyezd institutions. Lastly, the address calendar carried information on non-profit organizations and institutions (e.g., Russian Red Cross Society and Society of Arkhangelsk Physicians) (Adres-kalendar'..., 1900: I-VI).

Things were not much different in 1904, with the address calendar continuing to carry personal information across the same departmental groupings (Adres-kalendar'..., 1904: I-IV).

In 1905, in addition to what it used to publish previously, the directory of officials in state-run, non-profit, and charitable institutions in Arkhangelsk Governorate began to carry various pieces of reference information as well. Specifically, it began to publish a list of all volosts in the governorate, the distances from the city of Arkhangelsk to uyezd cities, mail collection and dispatch times, timetables for receiving and giving out mail, and some other useful information (Adres-kalendar'..., 1904: I-IV).

In 1907, they began to publish the Memorandum Book for Arkhangelsk Governorate. It is fair to note that attempts to publish memorandum books in Arkhangelsk Governorate had also been made earlier. Specifically, publications of this kind were produced from 1861 to 1865 and in 1888. Early 20th century memorandum books for the region consisted of two sections: Ethnography, History, and Statistics (Section 1) and Reference Information (Section 2). Section 2 was similar to the address calendar, whilst Section 1 was rich in sources on socio-economic development in Arkhangelsk Governorate. Also, the Memorandum Book for 1907 carried ethnographic material on peasant weddings in the southern part of Shenkursky Uyezd (Molchanov, 1907: 1-41). The same memorandum book carried a work by D.K. Zelenin entitled 'Arkhangelsk Governorate in the Early 19th Century' (Zelenin, 1907: 1-9). Finally, the third piece of material in Section 1 was represented by a statistical overview of Arkhangelsk Governorate for 1905 (Statisticheskii obzor, 1907: 1-30). The statistical overview encompassed the following sections: geographical position and area; climate; population; land ownership; arable farming; cattle farming and deer farming; fisheries; Murman fisheries; herring fishery; navaga and salmon fisheries and river and lake fisheries; marine mammal hunting; forest hunting; forest harvesting; seasonal work; factories; commerce; shipping; supply of food to the population; public education; post and telegraph; fires; scot and lot (Statisticheskii obzor, 1907: 1-30). Of note is the fact that all major entries in Section 1 were numbered starting from 1.

In 1908, the Memorandum Book had three sections in it. Section 1 was devoted to presentations from the First Congress of Physicians in Arkhangelsk Governorate, held in 1907. This section included a presentation by physician P.A. Kopansky, focused on the medical-and-sanitary conditions in the Murman fisheries sector (Kopanskii, 1908: 3-18), one by physician I.N. Shmakov, focused on medical-and-sanitary assistance for the Russian Laplanders (Shmakov, 1908: 19-36), and one by physician Ye.K. Mordvinov, focused on the daily life of the Zyryans in Pechorsky Uyezd (Mordvinov, 1908: 37-46).

Section 2 carried articles dealing with local statistics and ethnography. There was an article by N. Mamadyshsky, which addressed land ownership in Arkhangelsk Governorate (Mamadyshskii, 1908: 47-55). It also carried three ethnographic works – two unauthored works ('The Samoyeds of the Timan and Kanin Tundra' and 'Zyryan-Izhemian Weddings') (Samoedy..., 1908: 56-64; Svad'ba..., 1908: 65-67) and a piece by A. Malinovskaya ('Samoyed Weddings') (Malinovskaya, 1908: 68). Pages in this memorandum book were numbered continuously throughout.

The 1909 Memorandum Book for Arkhangelsk Governorate was somewhat different from the previous editions. Changes had been made to the titles of the sections. More specifically, whereas prior to 1908 use was made of the term "section" and a digit, in 1909 a different naming system was adopted, with the following being used: Academic Literature Section, Arkhangelsk Governorate Reference Information Section, Officers of State-Run and Non-Profit Institutions in Arkhangelsk Governorate, and several appendices (Pamyatnaya knizhka, 1909: 1-5).

The Academic Literature section carried a set of historical works, including A. Molchanov's 'The Solovetsky Monastery Uprising and Its Significance for the Schism as a Whole and the Pomor

Schism in Particular' (Molchanov, 1909: 1-38), S. Ogorodnikov's 'Facts From the Past of the City of Arkhangelsk' (Ogorodnikov, 1909: 39-48), and Yu. Kramer's 'Salt Production in Nenoksa' (Kramer, 1909: 49-73).

The Arkhangelsk Governorate Reference Information Section carried various pieces of useful information, including the distances between the region's populated localities, information about its lending institutions, and lists of large commercial organizations there. The Officers of State-Run and Non-Profit Institutions in Arkhangelsk Governorate section was not distinguished by anything extraordinarily new, but the appendices do merit dwelling upon. The issue for 1909 had two appendices. Appendix 1 (prepared by N. Golubtsov) contained a complete list of publications from the Arkhangelsk Gubernia Statistics Committee (Golubtsov, 1909: 187-197) and Appendix 2 (prepared by G. Boguslavsky) provided a list of manuscripts received by the Arkhangelsk Statistics Committee from Arkhangelsk house-owner M.D. Yeryukhin (Boguslavskii, 1909: 197-199). Appendix 1 included works published in the period beginning in 1850 (memorandum books for Arkhangelsk Governorate, directories, address calendars, works by the Arkhangelsk Gubernia Statistics Committee, titles within the Arkhangelsk Collection, reports by the Gubernia Statistics Committee, and freestanding titles).

In 1910, the following works were published in the Academic Literature section of the Memorandum Book for Arkhangelsk Governorate: N.F. Nikolayevsky's 'Damage to and Insuring Pomor Sailing Vessels' (Nikolaevskii, 1910: 1-74) and N. Golubtsov's 'Revisiting the History of the Delimitation Between Russia and Norway' (Golubtsov, 1910: 75-118), 'A Description of Emperor Alexander II's Visit to the City of Arkhangelsk and the Solovetsky Monastery' (Golubtsov, 1910a: 119-132), and 'Facts From the Past of Arkhangelsk Governorate' (Golubtsov, 1910b: 133-154). The last publication consisted of several standalone works: 'The Petitioning by Foreign Merchants Resident in Russia for the Establishment of a Postal Service from Moscow to Arkhangelsk', 'Documentation Held by the Ambassadorial Prikaz Relating to the Establishment of Archangelgorod Mail', 'Direction from the Novgorod Prikaz to the Town Hall With Regard to Payment for the Conveyance of Various Goods and Beverages from the Arkhangelsk Port to the Tsar's Residence and to the Performance of Other Types of Coachman Corvée', 'Edict to the Archangelgorod Town Hall Stringently Enjoining the Ustyug, Vaga, Dvina, and Kholmogory Burgemeesters to See to It That All Mail Continues to Be Delivered Without the Slightest Delay', 'Facts From the History of Exile to the Solovetsky Monastery', and 'Additional Materials on the History of the Conversion of the Samoyeds to Christianity' (Golubtsov, 1910b: 133-154).

There were no major changes to the reference information and officers sections. However, just like in 1909, the appendices carried two publications – V. Ul'yanovsky's 'Kemsky Uyezd's Karelia and Pomorye' (Ul'yanovskii, 1910: 3-9) and the unauthored 'Inhabitants of Kolguyev Island' (Obitateli..., 1910: 10-14).

In 1911, the Academic Literature section carried three works by N. Golubtsov, all devoted to M.V. Lomonosov: 'Mikhail Vasil'yevich Lomonosov' (Golubtsov, 1911: 1-29), 'M.V. Lomonosov's Role and His Descendants' (Golubtsov, 1911a: 30-39), and 'Memorialization of M.V. Lomonosov in Arkhangelsk Governorate' (Golubtsov, 1911b: 39-68). The reference information and officers sections were merged into one – Arkhangelsk Governorate Reference Information Section. This section began to carry statistics on the governorate, including data on its population, cultivated land, fisheries catch, and medical conditions (Pamyatnaya knizhka, 1911: 113-165).

In 1912, the Memorandum Book carried two works by A. Tret'yakov and two by N. Golubtsov: A. Tret'yakov's 'Revisiting the Settling of Arkhangelsk Governorate and Pinezhsky Uyezd in Particular' (Tret'yakov, 1912: 1-31) and 'Pinezhsky Uyezd' (Tret'yakov, 1912a: 32-64) and N. Golubtsov's 'Kholmogorsky Uyezd' (Golubtsov, 1912: 65-91) and 'Kemsky Uyezd' (Golubtsov, 1912a: 92-132). Essentially, the last three works were materials for the description of Arkhangelsk Governorate. The appendix carried another two works – whose titles suggested they dealt with sights in the city of Arkhangelsk and its environs. The first work, 'Churches, Monasteries, and the Diocesan Museum of Antiquities', was an unauthored one (Tserkvi..., 1912: 264-185). The second one, 'Historically Remarkable Places and Structures', was by N. Golubtsov (Golubtsov, 1912b: 286-302).

The year 1913 marked the 300th anniversary of the ascent to the throne of the Romanovs. Accordingly, the Memorandum Book for Arkhangelsk Governorate carried N.A. Golubtsov and A.N. Popov's 'The Arkhangelsk Region During the Time of Troubles', which incorporated quite sizable appendices (Golubtsov, Popov, 1913: 1-71). These included formal letters from Swedish voivodes to the Hegumen of the Solovetsky Monastery, Anthony, documents on the collection of

dues to fund the militiamen, material on the confinement of Filaret in the Siya Monastery, material on donations from contemporaries of the Time of Troubles to the Solovetsky Monastery, material on early 17th century Arkhangelsk, and much more. In addition, the publication included 'A Brief Overview of the City of Arkhangelsk and the Uyezds of Arkhangelsk Governorate' (Kratkii ocherk..., 1913: 72-125).

The Memorandum Book for 1914 no longer had the traditional Academic Literature section in it. It is only after providing all the reference information on the governorate that the publication listed some information about the Kanin Expedition of 1912 – more specifically, the preliminary report by the head of the expedition, A.V. Ivanov (Ivanov, 1914: 67-89).

In 1915, during World War I, the size of the Memorandum Book was cut in half – to 69 pages. The publication now again had two sections in it – the literature section and the reference information section. The literature section carried just one publication – A. Romanov's 'Revisiting the Development of a State-Run or State-Funded Well-Equipped Health Facility (Resort) on the Coast of the White Sea, in the Vicinity of the Una Bay' (Romanov, 1915: 1-12).

Finally, in 1916, the Table of Contents in the Memorandum Book was comprised of Section 1, Section 2, and Section 3. The first section carried information about the officers of government agencies across Arkhangelsk Governorate. The second section covered the region's local studies societies, banks, and shipping companies. The third section was concerned with loan societies, saving and loan associations, and consumer's societies. The publication's sections were again numbered continuously (Pamyatnaya knizhka, 1916: 1-59). The radical changes made to the design of the Memorandum Book in 1916 were associated with its long-time editor, N.A. Golubtsov, stepping down as Secretary of the Arkhangelsk Gubernia Statistics Committee.

Another important source on socio-economic development in Arkhangelsk Governorate was the work 'Arkhangelsk Governorate Overview for 1911', published through the efforts of the Statistics Committee in 1912 under the editorship of N.A. Golubtsov (Obzor..., 1912). This work merits detailed consideration, as a publication of this kind was produced only once. Its table of contents included the following sections: 1) Natural and Productive Forces of the Governorate and the Economic Activity of Its Population (this section covered areas such as area, population, animal husbandry, fisheries, forest hunting, commerce, and shipping); 2) Public Services and Amenities (e.g., port surveying, marine vessel insurance, loans, post and telegraph, and fires); 3) Forestry (e.g., timber sale, forest clearing, forest experimentation, and forest fires); 4) Colonization of Novaya Zemlya (composition of the settlers and their economy); 5) Healthcare (e.g., doctors, health institutions, medical conditions, smallpox vaccination, and drugstores); 6) Public Education (primary schools, general-education schools, and specialized educational institutions); 7) Scot and Lot (e.g., public dues, zemstvo dues, taxes owed, and accounting records). As we can see, the publication covered a great many aspects of socio-economic life in Arkhangelsk Governorate.

5. Conclusion

The production of yearly publications by the Arkhangelsk Gubernia Statistics Committee in the early 20th century was characterized by impermanence. In 1901–1904 the Committee published address calendars, in 1905 – a directory, in 1906 – another address calendar, and in 1907–1916 – memorandum books for Arkhangelsk Governorate. In addition, in 1912 the Committee released what would be a one-off – 'Arkhangelsk Governorate Overview for 1911'.

When the publication of memorandum books for Arkhangelsk Governorate commenced, there began to be published scholarly articles devoted to socio-economic development in the region. Most of those publications were prepared by staff members of the Arkhangelsk Gubernia Statistics Committee, who also held responsibility for the quality of other materials that were published by it. As was the case in most regions across the country, the production of yearly publications by the Arkhangelsk Gubernia Statistics Committee was cut short by the events of 1917 and the collapse of the Russian Empire.

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Cherkas Global University's Academic Projects: Open Academic Journals Index (2013–2023)

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Abstract

This paper details one of Cherkas Global University's projects – the creation and operation of the full-text international database Open Academic Journals Index (OAJI). It summarizes this activity over a 10-year period.

The principal sources for this study are the collection of documents 'Cherkas Global University (1992–2022)' and the annual report 'Academic Publishing House Researcher Today – 2013'.

The study's findings revealed that the database of open-access academic journals Open Academic Journals Index (OAJI), established in 2013, transformed into a full-text database as early as 2014. As of July 4, 2023, the database numbered 3,364 academic journals from 124 countries. OAJI-indexed journals have been divided into three groups (Natural Sciences (44.3 % of the total content), Social Sciences (42.7 %), and Multidisciplinary Sciences (13 %)). The Open Academic Journals Index platform currently contains over 200,000 articles from 360,000 researchers, which makes the ten-year old OAJI project one of Cherkas Global University's top international projects today.

Keywords: Open Academic Journals Index, Cherkas Global University, 2013–2023, academic projects, research.

1. Introduction

What is central to the history of any serious academic organization is the implementation of academic projects. These can vary in significance and form – such a project can be conducting research, holding thematic contests, implementing programs (e.g., something related to academic mobility), or creating scientometric tools. An example of the last is the full-text scientometric database Open Academic Journals Index, which is turning 10 this year, 2023. This academic project from Cherkas Global University is what constitutes the main focus of the present paper.

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2. Materials and methods

The principal sources for this work were the collection of documents 'Cherkas Global University (1992–2022)' (Cherkas Global University..., 2022) and the annual report 'Academic Publishing House Researcher Today – 2013' (Academic Publishing, 2014).

The study's methodology was grounded in the following fundamental historical principles: historicism, systematicity, and objectivism. Also, of importance was the use here of the statistical method, which was employed to create various samples on the Open Academic Journals Index platform (e.g., the number of journals across academic areas and the top 10 nations in terms of how many journals from a country are in OAJI).

3. Discussion

Up to now, there have been no dedicated publications on the Open Academic Journals Index database. The present work is intended to fill this gap in the historiography. Nonetheless, there are incidental mentions of OAJI in the literature, like those in the works devoted to Cherkas Global University and its founder, A.A. Cherkasov, Doctor of Historical Sciences. Specifically, an article was published in 2019 commemorating the 20th anniversary of A.A. Cherkasov's academic-pedagogical activity, which does mention OAJI among a few other projects (Tarakanov, Ludwig, 2019). That same year, 2019, V.V. Tarakanov and M.A. Ponomareva published a work detailing the first 5 years of the history of the International Network Center for Fundamental and Applied Research (INCFAR) (2014–2019) (Tarakanov, Ponomareva, 2019), which provides some information about OAJI as well; it also describes a methodology for calculating the Current Global Index of the Journal (CGIJ) (Tarakanov, Ponomareva, 2019: 989-990). In 2021, K.V. Taran addressed the operation of Cherkas Global University in the period 1992–2014, but, despite the fact that OAJI was already in place in 2013, no mention thereof is made in that work (Taran, 2021: 1077-1082). In 2022, an article commemorating the 30th anniversary of Cherkas Global University, 'Cherkas Global University (1992–2022): Yesterday, Today, and Tomorrow', was released by I.Yu. Cherkasova (Cherkasova, 2022). It describes in chronological order the history of the organization, with some attention devoted to the creation of OAJI as well (Cherkasova, 2022: 1041). In 2023, I.Yu. Cherkasova released another publication, in which the scholar focuses on the fundamental library of Cherkas Global University (Cherkasova, 2023). It is worth noting that the university currently has a library stock of more than 270,000 publications, with over 60,000 of these being in the fundamental library and over 200,000 – in the OAJI library.

Among the rest of the publications mentioning the OAJI database, of particular note is the work by V.S. Molchanova, focused on e-commerce in the publishing industry, which touches upon the database as well (Molchanova, 2015). In addition, there are incidental mentions of OAJI in the context of editorial policies for academic journals in the following works: Yu.B. Melnyk's 'Message from the Editor-in-Chief of *International Journal of Science Annals*' (Melnyk, 2021), V.I. Barsukov's 'Rules for Authors Regarding Article Submission' (Barsukov, 2017), and G. Rajović and J. Bulatović's '"History and Historians in the Context of the Time" in Thirteen Years of Existence' (Rajović, Bulatović, 2016).

4. Results

In 2013, the city of Sochi (Russia) was witnessing the brisk development of the academic publishing house Researcher, focused on the production of open-access academic journals. This organization experienced significant growth in 2010–2016, with the number of journals published by it eventually surpassing 50 (Figure 1).

The increase in the number of academic journals carried by the organization prompted a need for new places for indexing those journals to help boost their visibility. Consequently, there emerged the idea of launching an English-language database for open-access academic journals. This database was to provide the most relevant information about each indexed journal. On June 11, 2013, the head of the publishing house, A.A. Cherkasov, signed a decree to create the database Open Academic Journals Index. Pursuant to that decree, implementing the project would require enlisting the services of IT specialists, while oaji.net would be established as the web address for the database (Cherkas Global University..., 2022: 27). The logo for the database was also adopted shortly afterwards (Figure 2).

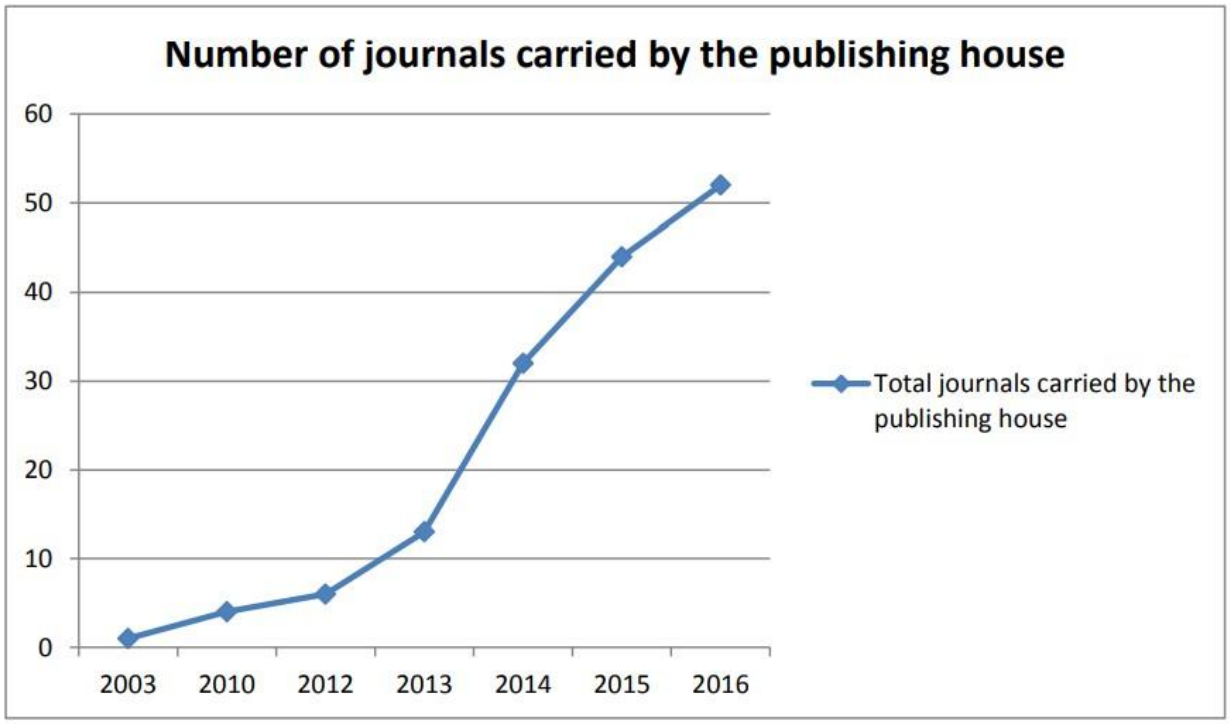

Fig. 1. Total number of journals carried by the publishing house Researcher in 2003–2016 (Tarakanov, Ludwig, 2019: 918)

Fig. 2. Logo for Open Academic Journals Index

On July 4, 2013, the work on creating the website was over and the first journal was placed on the OAJI platform – it was *Bylye Gody*, published by Cherkas Global University Press. Later on, other such journals followed suit (Academic Publishing..., 2014: 11). By August 19 of the same year, more than 100 journals from three countries (India, Iran, and Russia) had been added to the platform.

The page of a journal selected for indexing included the following information: the journal's title, its publisher, its periodicity, its short title, its publishing house's country of origin, its online and print ISSNs (International Standard Serials Number), its website's address, its editor-in-chief, its indexation by Web of Science, Scopus, and DOAJ, the date it was added to the OAJI system, the academic domain it is in, a brief description of the journal, and its indexation by other databases.

Journals in the database were subsumed into 25 academic areas across domains such as Natural Sciences, Social Sciences, and Multidisciplinary Sciences. There even was a separate niche for military sciences. A gap that needed to be filled was developing open-access academic journals, regarded as second-echelon. Back in 2013, A.A. Cherkasov put forward his own system for ranking academic journals as part of his presentation at Volgograd State Polytechnic University: "Category 1 – journals indexed by prestigious international databases (Scopus and WoS); Category 2 – journals indexed by open-access international databases (DOAJ and EBSCO); Category 3 – journals indexed by national databases (Science Index, Index Copernicus, etc.); Category 4 – journals not indexed by any database" (Tolmacheva, 2013: 28 iyunya).

By the end of 2013, the total number of journals in OAJI was 300. Ranked first in the number of journals in this database was India (164 journals), followed by Iran (45), and then Russia (37). Support for the operation of the database was provided first by specialists at the publishing house and later (starting in the summer of 2014) by those in the Department of Academic Information at the International Network Center for Fundamental and Applied Research (INCFAR). The staff

would examine journal indexation requests. Such a request would be granted if a journal met the requirements of OAJI's policy, and a letter would be automatically sent to that journal's editorial staff notifying them of the inclusion of the journal in the database, from which moment the journal could have OAJI's logo on its own website.

However, pretty soon it became clear that indexing academic journals only would not guarantee a competitive advantage. As a result, on January 16, 2014, OAJI began to transform into a full-text database, one that would index not only journals but scholarly articles in indexed journals as well. As a matter of fact, the decree on reorganizing the database into a full-text one, Decree of the Director of the International Network Center for Fundamental and Applied Research, A.A. Cherkasov, No. 7 of May 25, 2015, came out much – almost 1.5 years – later (Cherkas Global University..., 2022: 48). As a consequence, now the database was to contain not only articles by authors but also their names and the following items were to appear on a journal's page: number of articles per issue (the figure would be based on the average number of articles placed on the OAJI platform), number of articles, number of issues, language of a publication, and years from which a journal's issues are on the platform. The database was now equipped with search functionality and with such an important tool as OAJI Library. This would somewhat complicate the operation of the database, as automatic letters now included sign-in information (a login and a password) for uploading a journal's articles to the OAJI platform on one's own.

On February 23, 2014, the first thousand articles were uploaded to the full-text database. In all, it now indexed 423 journals from 42 countries. As testimony to the rapid pace of increase in content in the database, as early as March 11, 2014, the total number of journals indexed by it reached 500 from 50 countries.

On March 14, 2014, the staff at the publishing house launched a methodology for calculating the Current Global Index of the Journal (CGIJ). Individual for each journal, this value was to be calculated automatically based on factors such as indexation by other databases and the number of articles placed on the OAJI platform. The maximum and minimum CGIJ values within the OAJI system were to be 1.000 and 0.000, respectively (Figure 3).

Fig. 3. Page of a journal in OAJI, with the Current Global Index of the Journal (CGIJ) shown on it

On March 28, 2014, the number of authors in OAJI surpassed 10,000. A month later, on April 30, the number of journals indexed by OAJI reached 700 from 61 countries. It terms of content, there now were more than 8,500 articles and 15,000 authors.

On May 21, 2014, the number of articles in the database reached 10,000. It now indexed 772 journals from 65 countries.

Five months later, by October 20, 2014, the number of articles in OAJI had doubled, reaching 20,000, with the number of journals indexed by the database totaling 1,146 from 73 countries.

On November, 14, 2014, the number of journals indexed by OAJI surpassed 1,200. There was a change in the top three – India, Russia, and USA.

On December 8, 2014, the number of articles indexed by OAJI reached 25,000, with the database numbering 1,253 journals from 73 countries and containing 40 GB worth of content.

On January 20, 2015, the number of journals on the Open Academic Journals Index platform reached 1,300 from 75 countries, and as early as February 2, 2015, the number of authors therein surpassed 50,000.

The reorganization of the database into a full-text one had a positive effect in terms of the website's traffic, with the figure continuing to be high – an average of 2,000 visitors daily, peaking at 5,000.

Subsequently, the numbers of journals, articles, and authors in OAJI continued to grow. In 2017, as a result of the launch of the content cleaning process, the indexation of some of the journals was discontinued, with new ones being admitted in their place. As early as by 2020, the number of journals indexed by the database had reached 3,000 – as against the initial plan of indexing 3,000 to 3,500 journals.

On December 31, 2022, the database numbered 3,343 journals from 122 countries, with the numbers of authors and articles therein reaching 363,000 and upwards of 200,000 articles, respectively.

On the eve of its 10th anniversary, on July 4, 2023, OAJI contained 130.5 GB worth of content. It indexed 3,364 journals from 124 countries. Over the period the database has been in existence, there have been more than 13,000 requests from journals to be indexed by it, or about four requests per day. The approval rate has been around 25 %.

Table 1. Distribution of Journals in OAJI across Academic Areas

Academic area	Number of journals
Agricultural Sciences	180
Architecture	17
Biological Sciences	186
Chemical Sciences	52
Computer Sciences	57
Cultural Studies	29
Earth and Related Environmental Sciences	48
Economic Sciences	262
Engineering Sciences	268
Geosciences	55
Health Sciences	92
Historical Sciences and Archaeology. Art History	97
Humanities	230
Legal Sciences	100
Mathematics and Information Sciences	33
Medical Sciences	414
Military Sciences	17
Multidisciplinary Sciences	440
Pedagogical Sciences	148
Philological Sciences	38
Philosophical Sciences	36
Physical Sciences. Astronomy	12
Physico-Mathematical Sciences	41
Political Sciences	34
Social Sciences	444
Technology	34
Total	3,364

As evidenced in Table 1, the overall content of OAJI-indexed journals has been divided across the academic areas as follows: 1,489 journals focused on the natural sciences (44.3 %),

1,435 journals focused on the social sciences (42.7 %), and 440 journals focused on the multidisciplinary sciences (13 %). Figure 4 provides a diagram for a visual representation of this.

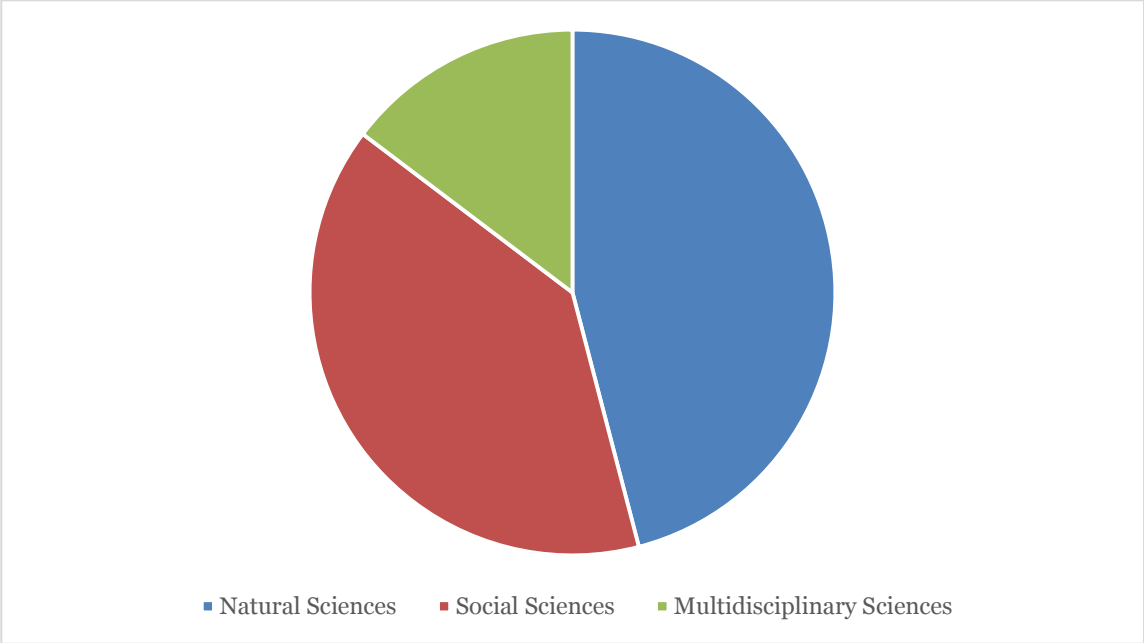

Fig. 4. Visual distribution of journals in OAJI across the three major academic domains

By July 4, 2023, OAJI numbered 3,364 academic journals from 124 countries. Table 10 displays the top 10 nations in terms of the number of journals from a country indexed by the database (Table 2).

Table 2. Top 10 Countries by Number of Journals in OAJI as at July 4, 2023

Rank	Country	Number of journals
1	India	448
2	Brazil	348
3	Ukraine	227
4	Turkey	200
5	Indonesia	191
6	USA	182
7	Iran	150
8	Russia	125
9	Romania	116
10	Colombia	70

As evidenced in Table 2, there are several nations that have taken a keen interest in the development of open-access academic journals. Above all, these are India and Indonesia, with Brazil, too, joining in recently. There have been many journals from Ukraine and Turkey. Note also that OAJI currently indexes just 12 journals from China, which pretty much reflects the policy followed by this Asian nation.

5. Conclusion

The database of open-access academic journals Open Academic Journals Index (OAJI), established in 2013, transformed into a full-text database as early as 2014. As of July 4, 2023, the database numbered 3,364 academic journals from 124 countries. OAJI-indexed journals have been divided into three groups (Natural Sciences (44.3 % of the total content), Social Sciences (42.7 %), and Multidisciplinary Sciences (13 %)). The Open Academic Journals Index platform

currently contains over 200,000 articles from 360,000 researchers, which makes the ten-year old OAJI project one of Cherkas Global University's top international projects today.

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