European Journal of Contemporary Education

Has been issued since 2012.
E-ISSN 2305-6746
2020, 9(3). Issued 4 times a year
MIAR ICDS 2020 – 9,4

Journal is indexed by: **Cross Ref** (USA), **EBSCOhost Electronic Journals Service** (USA), **Electronic scientific library** (Russian Federation), **Global Impact Factor** (Australia), **Index Copernicus** (Poland), **Journal Index** (USA), **Open Academic Journals Index** (USA), **Scopus** (Netherlands), **Web of Science** (USA).

All manuscripts are peer reviewed by experts in the respective field. Authors of the manuscripts bear responsibility for their content, credibility and reliability.

Editorial board doesn't expect the manuscripts' authors to always agree with its opinion.

Postal Address: 1367/4, Stara Vajnorska str., Bratislava – Nove Mesto, Slovak Republic, 831 04

Website: http://aphrsro.net
E-mail: ejce.aphr@gmail.com

Founder and Editor: Academic Publishing House Researcher s.r.o.

Release date 15.09.20.
Format 21 × 29,7/4.

Headset Georgia.

Order № 232.

European Journal of Contemporary Education

2020

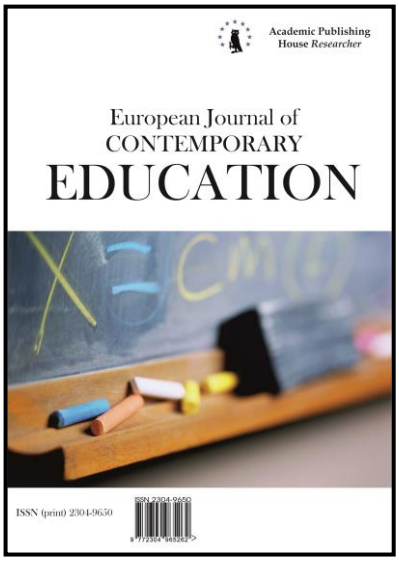
Is. 3

C O N T E N T S

The Problems of Contemporary Education

The History of Education

Published in the Slovak Republic
European Journal of Contemporary Education
E-ISSN 2305-6746
2020, 9(3): 484-489
DOI: 10.13187/ejced.2020.3.484
www.ejournal1.com



The Problems of Contemporary Education

After-School Mathematics Tutorials in Ghana: A Qualitative Study on Senior High Students' Psychosocial Experiences

Henry Adusei [a], Jacob Owusu Sarfo [b, c, d, e, *]

[a] University of Education, Winneba, Ghana
[b] University of Cape Coast, Cape Coast, Ghana
[c] All Nations University, Koforidua, Ghana
[d] International Network Center for Fundamental and Applied Research, Washington, USA
[e] Volgograd State University, Volgograd, Russian Federation

Abstract

Mathematics is an important subject in senior high education as it forms the basis for most taught subjects. In Ghana, it is a common practice to find parents enrolling their children in private after-school mathematics tutorials. Teachers who teach after-school tutorials usually organize class after school hours or during the weekends for a fee. Also, teaching can take the form of one-to-one private tuition or group tuition. Although after-school mathematics tuition has become a common practice, little is known regarding the experiences of these senior high students who receive this tuition in Ghana. We purposively sampled 35 senior high students from public schools for both individual and group interviews. Using interpretative phenomenological analysis, we observed that private tutorial learning in mathematics increased students' understanding of the subject. Students who had this extra tuition also expressed a dramatic improvement in their performance in mathematics. Nevertheless, we observed that students felt bored when there was a repetition of topics that had already been taught in class. Furthermore, we observed that participants perceived this additional tuition as an additional academic stressor as it prevented them from having adequate rest and extra-curricular activities. We recommend that the Ministry of Education, Ghana Education Service, and other stakeholders should regulate the private after-school mathematics tutorials in Ghana.

Keywords: after-school tutorials, Ghana, high school students, mathematics.

* Corresponding author
E-mail addresses: sarfojo@yahoo.com (J.O. Sarfo), henadusei@gmail.com (H. Adusei)

1. Introduction

Ghana's educational system has evolved through many stages since colonial rule (Graham, 1971). Ghanaian basic education begins with two years of kindergarten, six years of primary education, three years of junior high education as well as three years of senior high education (Iddrisu et al., 2017). At all these stages of education, the teaching and learning of mathematics play an integral role (Adusei et al., 2016; Azigwe et al., 2016).

At the senior high education, mathematics plays a very essential role. Specifically, it forms about 63 % of their core and elective subjects in Ghana (Sarfo, Adusei, 2016). Most Ghanaian students attend extra classes in mathematics but little is known about their life-time experiences (Dennis et al., 2018). Often, after-school tutorials are privately organized by teachers and private educational institutions for a fee in Ghana and it is popularly called "extra-classes" (Sottie, 2017). According to Krishnaswamy et al. (2019), after-school tutorials can take these forms; "(i) one-to-one private tutorial teaching, (ii) school teachers who teach students after daily school, and (iii) professional private tutors who set up classrooms and operate the business by providing lectures to students." (p. 203).

In practice, the after-school mathematics tutorial refers to having organized teaching in mathematics outside the normal school contact hours. Though recommended by some Ghanaians in authority, others vehemently have condemned it, especially owing to the exorbitant fees teachers charge (Sottie, 2017). Like Ghana, 4 out of 5 school children in Shanghai also attend after-school tutorials groups in the evenings and at weekends (Organisation for Economic Cooperation and Development, 2010). The purpose of this current study is to explore the reasons, benefits, and challenges of students engaging in extra classes in mathematics in Ghana.

2. Materials and methods

Participants

Thirty-five (35) senior high students from different senior high schools in Ghana were purposively selected for either individual or group interviews (see Table 1). These students studied core and elective mathematics as part of their three-year senior high program. Twenty-seven participants were selected for the individual interviews until saturation while 8 participants were selected for the group interview. The gender disparity was objectively based on the availability and willingness of participants to participate. Their average stay in the school and the average ages were approximately 12 and 17 years respectively.

Table 1. Participants' data collection methods

Method	Number of Interviews
Individual interview	27 (17 male, 10 female)
Group interview	8 (3 male, 5 female)

Both individual and group interviews were done to ensure triangulation, quality interaction among homogenous groups of students since they were hesitant during the individual session to provide information (Creswell, 2013). Tables 1, 2 give summaries of participants' data collection methods, and participant demographics respectively.

Table 2. Participant demographics

Age (Years)	Total Number	Gender Distribution
15	3	1 male, 2 females
16	6	4 males, 2 females
17	22	12 males, 10 females
18	4	3 males, 1 female

Measures

We developed semi-structured interview guides for both individual and group interviews with assistance from a mathematics teacher. We also administered it out to 3 senior high students to ensure clarity and accuracy of items. Sample questions asked included: "have you taken core/elective mathematics extra classes before?"; "what are the reasons why you engaged in mathematics classes?"; "can you share the benefits of attending extra classes? Asking these open-ended questions allowed our study's participants the liberty to tell their story devoid of restraint. Additional prompts were used to enhance explanation and also to maintain. These questions were planned to aid interviewees to come out clearly with their experiences and their respective meanings rather than serving the goal of leading questions (Creswell, 2013). At the close of the interview, participants were asked a leading question; "is there something you feel is important that you want to add? This was done to get additional information. The one-on-one interviews lasted between twenty to thirty minutes per session while the group interview lasted for forty-five minutes.

Data Analysis

Concerning data analysis, all audio-recorded interviews were transcribed and simultaneously analysed manually using the interpretative Phenomenological Analysis until theoretical saturation (Creswell, 2013). To ensure confidentiality, fully transcribed interviews with names were completely anonymized and the participants were given codes to hide their identity. The purpose of this study was to ascertain the effect of extra-classes and performance in Mathematics in Ghana. The Interpretative Phenomenological Analysis was used to explore the experiences of sampled senior high students. This research method offers a methodical and explicit description of life-time experiences of subject matter (Creswell, 2013).

3. Results

At theoretical saturation, 2 main themes and 6 subthemes emerged during our analysis. Table 3 shows a summary of themes and their respective sub-themes.

Table 3. Thematic output of the summarized data

Themes	Sub-themes	Sampled quotes
1. Advantages of after-school math tutorials	i. Enhances understanding of math lessons [n=30]	"…after engaging in mathematics extra classes for three terms, mathematics questions have become easy to solve since more knowledge has been acquired." SRf5 "…improves my learning of math." SRf8
	ii. Additional period for math lessons and revision [n=35]	"It helps me to finish the term's syllabus very quickly and revise." SRf8
	iii. Improves performance in math tests [n=25]	"At first, my grades in mathematics were ranging between D7 -F9 but after taking extra classes in the third term of my second year, there has been an improvement to C5 and I am hoping for the better this year." SRm2

2. Disadvantages of after-school math tutorials	i. Boredom due to repetition of already taught lessons [n=28]	"My main aim of having extra classes was to supplement what is been done in class but if the same topic you have treated in class is been taught after class, it makes the lessons boring." SRm12
	ii. Extra tuition fee cost [n=22]	"I see myself as someone who needs extra tuition for most subjects but my parents could not afford the charges... so, I am only attending math tutorials for now." SRm10
	iii. Academic stressor [n= 24]	"...after-school math tutorials are normally done after our classes ... Students who engage in extra classes will always have less rest during the day and sometimes lead to stress" SRm2

Notes: n=number of sample for a particular sub-theme

4. Discussion

The goal of the study is to explore the experiences of senior high school students who patronise after-school mathematics tutorials in Ghana. Two major themes and 6 subthemes were observed after analysis. The findings indicated that after-school mathematics tutorials for senior high students in Ghana have several advantages. Consistent with the findings of Forrest et al. (2017), math tutorials augment students' understanding of math lessons that are taught during class. Also, students in this study reported that receiving after-school tutorials afforded them extra hours of math lessons and revision. Consequently, such tutorial periods offered students pleasant and relaxed moments to receive math lessons according to their pace (San Jose, 2019). Krishnaswamy et al. (2019) confirmed that the inflexibility of the Malaysian school system promoted students' preference for private tutorial learning.

Subsequently, most of the participants reported an improvement in their mathematics examination scores. In a report to improve the academic performances among disadvantaged students, an increase in individual tutorials was noted as the best remedy (Ander et al., 2016). According to Huang (2013), the national average performance of sampled countries in both mathematics and science increased when after-school tutorials were offered to students. Besides, studies by Butty et al. (2001) and Moreno et al. (2016) also pointed to these as benefits of after-school tutorials. Likewise, Kim and Park (2007) reported Korean parents enrolled their children in private tutorials to increase their chances of gaining admission to universities.

Aside from the advantages participants obtained from private after-school tutorials in mathematics, they reported some key disadvantages. Some of the participants reported that they experienced some level of boredom when lessons that are taught during school hours are repeated at private tutorial learning. In an electroencephalograms (EEG) study of learners' brain waves, EEG changes when students were bored. The boredom of students, according to researchers was attributed to the repetition of the same lessons (Katayama, Natsume, 2012).

Additionally, some of the participants complained that their parents could not afford the fees charged by their after-school tutorials' teachers. Confirmed by Qian (2014), after-school tutorials place an undue financial burden on parents, particularly among poor families. In Ghana, media reportage by Sottie (2017) noted that the Regional Director urged teachers not to charge fees for after-school tutorials. This directive seems impossible until teachers are well paid and better education policies are enacted (Ille, Peacey, 2019). Furthermore, most of the participants reported less rest after class because they have to attend after-school tutorials. They complained that this led to an increase in their levels of academic stress. Studies over the years have outlined the negative

effect that academic stress has on the quality of life of students (Bedewy, Gabriel, 2015; Jayanthi et al., 2015).

5. Conclusion and recommendations

Mathematics forms an essential part of Ghana's senior high education. We noted from our findings that students in Ghana engage in after-school mathematics tutorials due to its benefits. Our study revealed that private mathematics tuition classes help students to understand math lessons well and improve academic performance. Notwithstanding these advantages, some participants also reported challenges like boredom, financial burden, and academic stress as some of the negative effects of this form of tuition. In the future, the government and stakeholders in education must enact policies and systems to regulate after-school tutorials for senior high students in Ghana. Furthermore, the government should provide teachers with incentives and adequate salaries to discourage them from charging students exorbitantly for private after-school tuition.

6. Acknowledgments

We are grateful to all the participants and school authorities for their support.

7. Conflict of interest

The authors declare that there was no conflict of interest.

References

Adusei et al., 2016 – *Adusei, H., Sarfo, J.O., Manukure, P., Cudjoe, J.* (2016). "If I should stop teaching now, where will I go?" Turnover intentions among high school teachers in Ghana. *European Journal of Contemporary Education*. 17(3): 263-271.

Ander et al., 2016 – *Ander, R., Guryan, J., Ludwig, J.* (2016). Improving academic outcomes for disadvantaged students: Scaling up individualized tutorials. Report prepared for the Brookings Institute. Washington DC: Brookings Institute.

Azigwe et al., 2016 – *Azigwe, J.B., Kyriakides, L., Panayiotou, A., Creemers, B.P.* (2016). The impact of effective teaching characteristics in promoting student achievement in Ghana. *International Journal of Educational Development*. 51: 51-61.

Bedewy, Gabriel, 2015 – *Bedewy, D., Gabriel, A.* (2015). Examining perceptions of academic stress and its sources among university students: The perception of academic stress scale. *Health psychology open*. 2(2): 2055102915596714.

Butty et al., 2001 – *Butty, J.A.L.M., LaPoint, V., Thomas, V.G., Thompson, D.* (2001). The changing face of after-school programs: Advocating talent development for urban middle and high school students. *NASSP Bulletin*. 85(626): 22-34.

Creswell, 2013 – *Creswell, J.W.* (2013). Qualitative inquiry & research design: Choosing among five approaches (3rd ed.). Thousand Oaks, CA: Sage.

Dennis et al., 2018 – *Dennis, H., Mereku, D.K., Alhassan, M.N.* (2018). Influence of teachers' coverage of mathematics curriculum materials (MCM) on their schools' performance in mathematics. *African Journal of Educational Studies in Mathematics and Sciences*. 14: 33-38.

Forrest et al., 2017 – *Forrest, R.L., Stokes, D.W., Burridge, A.B., Voight, C.D.* (2017). Math remediation intervention for student success in the algebra-based introductory physics course. *Physical review physics education research*. 13(2): 020137.

Graham, 1971 – *Graham, C.K.* (1971). The history of education in Ghana: From the earliest times to the declaration of independence. Oxon: Frank Cass & Co.

Huang, 2013 – *Huang, M-H.* (2013). After-school tutoring and the distribution of student performance. *Comparative Education Review*. 57(4): 689-710.

Iddrisu et al., 2017 – *Iddrisu, A.M., Danquah, M., Quartey, P.* (2017). Analysis of school enrollment in Ghana: A sequential approach. *Review of Development Economics*. 21(4): 1158-1177.

Ille, Peacey, 2019 – *Ille, S., Peacey, M.W.* (2019). Forced private tutoring in Egypt: Moving away from a corrupt social norm. *International Journal of Educational Development*. 66: 105-118.

Jayanthi et al., 2015 – *Jayanthi, P., Thirunavukarasu, M., Rajkumar, R.* (2015). Academic stress and depression among adolescents: A cross-sectional study. *Indian pediatrics*. 52(3): 217-219.

Katayama, Natsume, 2012 – *Katayama, T., Natsume, K.* (2012). The change in EEG when we are bored. *Journal of Signal Processing*. 16(6): 637-641.

Kim, Park, 2007 – *Kim, J.H., Park, D.* (2007). The determinants of demand for private tutoring in South Korea. *Asia Pacific Education Review*. 11(3): 411-421.

Krishnaswamy et al., 2019 – *Krishnaswamy, J., Seow, S.K., Annamalai, N.* (2019). The shadow education system: Students' responses to private tutorial learning. *Malaysian Journal of Learning and Instruction*. 16(2): 201-225.

Moreno et al., 2016 – *Moreno, N.P., Tharp, B.Z., Vogt, G., Newell, A.D., Burnett, C.A.* (2016). Preparing students for middle school through after-school STEM activities. *Journal of Science Education and Technology*. 25(6): 889-897.

Organization for Economic Cooperation and Development, 2010 – Organization for Economic Cooperation and Development. Strong performers and successful reformers in education: Lessons from PISA for the United States. Paris, France: Organisation for Economic Cooperation and Development, 2010.

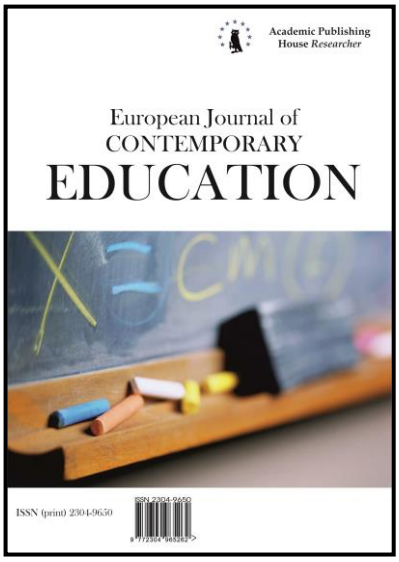
Qian, 2014 – *Qian, D.D.* (2014). School-based English language assessment as a high-stakes examination component in Hong Kong: Insights of frontline assessors. *Assessment in Education: Principles, Policy & Practice*. 1-20.

San Jose, 2019 – *San Jose, A.E.* (2019). We need your help: An evaluation of students' tutorial experiences in mathematics and science. *Journal of Humanities and Social Sciences Invention*. 1(1): 1-7.

Sarfo, Adusei, 2016 – *Sarfo, J.O., Adusei, H.* (2016). Math anxiety and achievement among male senior high students in the Eastern Region of Ghana. *Africa: History and Culture*. 2(2): 33-37.

Sottie, 2017 – *Sottie, E.E.* (2017, July). Don't charge fees for extra classes – Regional Director. GraphicOnline. [Electronic resource]. URL: https://www.graphic.com.gh/news/education /don-t-charge-fees-for-extra-classes-regional-director.html (date of access: 03.03.19).

Published in the Slovak Republic
European Journal of Contemporary Education
E-ISSN 2305-6746
2020, 9(3): 490-504
DOI: 10.13187/ejced.2020.3.490
www.ejournal1.com



Development Factors of the Lecturers' Professional Mobility in System of Higher Education in Kazakhstan

Bakytzhan Z. Aidarov [a, *], Yussubali N. Kamalov [a], Nazira P. Tangkish [a]

[a] M. Auezov South Kazakhstan State University, Shymkent, Kazakhstan

Abstract

Internationalization and integration of the educational environment raises the issue of university lecturer development of professional mobility in Kazakhstan's higher education system. The aim of the study is to find an empirical approach to defining the factors for the development of lecturer professional mobility in the modern conditions of functioning of higher education in Kazakhstan. Using the cluster analysis and justification of the efficiency criterion, the researcher conducted a representative sample of 30 local universities. In order to obtain quantitative estimates of their professional mobility level, the researcher surveyed 1109 lecturers from a sample set of Kazakhstan universities. To determine the structure and factors of professional mobility and the role of the resource component in professional mobility, the researcher employed principles component analysis, which was carried out on the basis of the quantitative estimates obtained as a result of the survey. Finally, the influence of pedagogical mobility factors on the efficiency level of the university was studied using regression models made using the method of nonlinear evaluation. The results of the study are of a practical nature. To know the factors of professional mobility is fundamental for educational management as it determines the ratio of resource and process components that underlie the coordination of interests of both the employee and the university, as well as the strategy for the development of lecturers in universities. This, in turn, can significantly increase the efficiency of their activities, as well as ensure the success of integration into the world educational space.

Keywords: Kazakhstan, professional mobility, lecturer, higher education, factors, resource components, process components, universities.

1. Introduction

Teaching and learning to teach can be defined as complex, multifaceted, value-laden enterprises that are managed against the global backdrop of the so-called knowledge society.

* Corresponding author
E-mail addresses: bzh.aidarov@bk.ru (B.Zh. Aidarov)

The continuum of lecturer learning and education, which turns out to be fundamental in a lifelong learning perspective, implies the need for extended lecturer professionalism (Caena, 2011; Yazan, 2018). In most cases, the quality of higher education depends on the quality and competence of university teaching staff (Jusuf et al., 2020). By pedagogical competences, we understand those professional skills and abilities that are indispensable for the successful work of a present-day university lecturer. The document "Common European Principles for Lecturer Competences and Qualifications", elaborated by a working group of experts form EU member states contains one of the key requirements for lecturers; namely, to act as responsible professionals in local educational communities and with different actors, promoting the development of students as European citizens with global responsibilities and encouraging dispositions and attitudes to cooperation and mobility, intercultural dialogue and mutual respect (European Commission DG Education and Culture, 2020).

By circumstance, the modern world has created a single educational space, which determines the harmonization of educational standards, approaches, curricula, and specialties in different countries (Woldegiyorgis, 2018; van der Aa et al., 2019; Usembayeva et al., 2016; Mihut et al., 2017; Patrinos, Angrist, 2019; Jumakulov, Ashirbekov, 2016). The open educational space implies the increased cooperation of university professors from different countries, in particular from Kazakhstan, which is expected to contribute to the success of people in their chosen profession, as well as to improve the system of employment of university graduates and to enhance the status of these countries in the field of education. The Head of State has identified three basic aspects of the intellectual formation of the nation: 1) breakthrough in the development of education and science, 2) increasing the scientific potential of the country, and 3) the development of an innovation system (Official Website of the President of the Republic of Kazakhstan, 2018; Strategy 2050, 2020). The Ministry of Education and Science (Government of the Republic of Kazakhstan, 2020) controls all these processes. Continuously generating initiatives aimed at enhancing the development of human capital, the Ministry justifiably targets universities to improve their organizational, managerial, and professional competencies. Professional mobility is one of the most important aspects of the process of integration of HEIs and science into the international educational space and improvement of quality of the higher education system (Vitenko et al., 2017).

Kazakhstan has a national strategy for the internationalization of higher education and belongs to a category of countries where inward and outward professional mobility of staff is part of the national strategy. The percentage of higher education institutions that have adopted this strategy is 100 % in Kazakhstan (Analytical report..., 2018). Kazakh universities are also actively involved in the joint projects of international organizations, such as UNESCO, UNICEF, DAAD, ERASMUS+, Mevlana, and others. The main sources of project financing are international coordinators. Every year, the range of alternative sources of the program of external outgoing academic mobility increases (Analytical report..., 2018; Gabdulina, Zhuman, 2019). Kazakhstan lecturers are given a unique opportunity to participate in various international programs. In this aspect, international organizations provide significant support to the country's higher education institutions. For example, the British Council project has supported setting up Professional Development and Cooperation Centers in Kazakhstan's higher education institutions (Analytical report..., 2018). The work of these centers is aimed at improving the professional competencies of researchers and other university staff in order to develop international cooperation and maximize the effectiveness of their work. The project united Sh. Yesenov State University of Technology; S. Baishev Aktobe State University; E.A. Buketov Karaganda State University, A. Baitursynov Kazakhstan State University, M. Auezov South Kazakhstan State University; and Kazakh-American Free University (Analytical report..., 2018).

However, despite the fact that practical steps are being taken to implement efficient professional pedagogical mobility, it should be noted that its level in the higher education system of Kazakhstan remains at a very low level. The absence of official statistics on the mobility of university lecturers indicates that this aspect of the national strategy of improving the quality of education in the country has not received due attention in practice. Most scientists, considering this issue, identified a number of destructive factors, such as the low level of funding (Abdiraiymova et al., 2013; Ahn et al., 2018) and the low level of English ability (Seitzhanova et al., 2015) (only 6.8 % of lecturers in Kazakhstan's higher education institutions can give lectures in English) (Analytical report..., 2018). Yet it should be noted that professional mobility is being

formed and developed under the influence of objective and subjective factors (Gabdulina, Zhuman, 2019; Shegda, 2016; Bense, 2016). Mobility acts as an integrative education that incorporates the personal and activity components that exist and develop in unity, mutually conditioning each other (Shegda, 2016). Therefore, the objectives of this study were to empirically determine the structural components of the professional mobility of lecturers in higher education, to determine their priority and the nature of their impact on the efficiency of higher education institutions, and to justify the priority areas for the development of lecturer professional mobility in today's conditions, deferring to the experience of foreign countries and taking into account the specifics of Kazakhstan's education system.

The paper is divided into several sections as follows: Section 2 reviews the literature; Section 3 provides an outline of the factors and hypotheses of this study and describes the research methodology; Section 4 describes the data collection; while the data analysis and results are discussed in Section 5. Finally, Section 6 summarizes the conclusions of this study, with recommendations outlined in Section 7.

2. Literature review

The concept of "professional mobility" is present in the scientific literature since the early 1950s. At first it was interpreted as a change of various types of occupations or professions as related to physical, non-physical, and farm types of labor (Pavlenko, 2017). Thanks to the works of American sociologists Lipset & Bendix (Lipset, Bendix, 2018), professional mobility has been given the status of an independent subject of research. The study of the problem of professional mobility is rooted in the study of the phenomena of the division of labor and social displacements. According to Durkheim (Durkheim, 2014), the division of labor is the main factor of social progress. The individualization of social behavior associated with the intensification of the division of labor, mentioned by Durkheim (Durkheim, 2014), was contained in the concept of the "flexible", which he introduced for assessment of the relations change in the "man-labor" system. This concept reflects the capability and possibility of an individual to form his labor, his professional orientations and prospects. A characteristic feature of a "plastic" worker is the constant internally determined increase in the level of self-competitiveness, identification of new opportunities for his profession and new forms of professional self-actualization. The definition of "professional mobility" traditionally includes the ability of an expert to change professions, places and kinds of activity (Pavlenko, 2017). It should be noted that the dynamics of modern public life makes its own adjustments to the understanding of the concept of professional mobility, without confining professional mobility within one industry, and considering the professional mobility as an opportunity for professional and personal self-realization in any sphere of socio-economic and socio-cultural activities. In other words, professional mobility is considered as an indicator of flexibility of an employee, i.e. his or her ability to adapt to new working conditions, such as the technological development; introduction of new technology or software; promotion or transition to a related position; necessity to master a new profession, etc (Abd, Behadili, 2019).

Active consideration of this problem within a framework of professional pedagogy started in the 1970s. Professional mobility at that time was defined primarily as the willingness of the worker, including the civil servant, to rapidly change production tasks, jobs and even specialties within the same profession or industry, as well as the ability to quickly master new specialties or changes in them that arise under the influence of technical transformations (Bense, 2016). Professional mobility is an important element for the career development for lecturers as well, but also in other areas of activity, especially since the young generation is more flexible considering the career change (Zamir, 2018). Professional mobility in pedagogical field, as in material production and other spheres of employment, is predetermined by objective factors, but its course and intensity of formation and development depend more on personal, subjective factors (Iucu et al., 2011; Zamir, 2018). Professional mobility is a process where by a lecturer has the opportunity to develop both personally and professionally. The secure lecturer feels confident where she is and wishes to learn and advance. At the same time, for there to be mobility, the lecturer needs a sense of personal and organizational empowerment. Someone who feels appreciated, whose opinion is worth something within the organization, will develop the desire to grow within it (Bense, 2016). Mobility does not occur necessarily in a bottom-up process, in other words it is not necessarily a job promotion to a more senior position, and it may also be lateral mobility expressed in greater professionalization

within the teaching field. Sometimes this kind of mobility leads society to sense that the person is "treading water" career-wise, even though that person doesn't actually feel that way (Steffy et al., 1999).

However it should be noted that there is also a scientific point of view in the relevant literature concerning the priority of material factors for the development of lecturer academic mobility in the educational environment (Gabdulina, Zhuman, 2019; Jumakulov, Ashirbekov, 2016). Especially, when it comes to the higher education in developing countries, in particular in Kazakhstan. Lack of adequate funding for education significantly hinders the implementation of a service that would inform on participation in foreign programs, differences in the structures of educational programs and courses, transfer of credits and assessments, harmonization of curricula between universities, etc. (Abdiraiymova et al., 2013; Ahn et al., 2018).

Despite the differences in views of researchers on the list of factors and their priority of influence on the lecturer professional mobility, they are unanimous on the direct proportionality of the influence of complementary factors of mobility on the efficiency of higher education institutions (Malikov, 2014; Monobayeva, 2013; Belyakova, 2014).

Having considered the phenomenon of a lecturer professional mobility in potential and actual aspects, we concluded that this integrative quality of the personality of an expert can be represented in two interdependent planes: as a personality trait and as a characteristic of activity in cognitive and professional processes. Therefore, in this study, the professional mobility of a lecturer will be considered as internal freedom, personal self-improvement based on stable values and the need for self-organization, self-determination and self-development, and the ability to respond quickly to changes in society using professional competences. According to Zeer (Zeer, 2014), this can provide vocational education with "convertible", social and professional mobility. Most of the studies on lecturer professional mobility are positioned within a larger body of research that identifies factors that have been linked to lecturer rotational mobility (Bense, 2016; Lipset, Bendix, 2018; Zamir, 2018). These studies are often policy-focused and emphasize practical steps that school districts and states can take to retain lecturers. Given the policy-oriented nature of these studies, almost none of them clearly articulate a theoretical framework (Iucu et al., 2011; Pavlenko, 2017).

Researchers emphasize a set of common characteristics: lecturer personal skills or the moment in which they are in the career. A major factor which is emphasized is the need for professional and personal development (Appleton et al., 2006; Garam, 2007). This is consonant with the formation of lecturers and the motivation for choosing the teaching career and work in this area (Iucu et al., 2011) put forward that professional mobility is in direct proportion with every lecturer's career expectations.

Disagreement over the factors determining professional mobility in the pedagogical field may be explained by the ambivalence inherent in professional work: the discord between lay people who appraise professional performance in terms of outcomes, and professionals who tend to judge performance in terms of what is accomplished in relation to contextual constraints of the specific situation.

Practically implementing approaches to the development of professional mobility of lecturers in the higher education system, it is necessary to pay attention to the study of both external and internal systems of personal value-based relations, revealing the general nature of their interaction. We are interested in what lecturer needs in order to build the concept of continuous professional self-identification as a system that comprises two sub-systems, external (social professional) and internal (personal). The external subsystem ensures awareness of changes in the world of professional activity. The personal subsystem presupposes self-assessment by the lecturer of his interests, abilities, aptitudes, determines his attitude to professional values and norms and reveals the direction of dominant motives.

3. Data

To determine the structure of lecturer professional mobility, a survey of Kazakh universities was conducted. The list of universities participating in the survey was determined through hierarchical clustering and stochastic indicators of universities' efficiency and participation in world education rankings. The most comprehensive list of Kazakh universities is found in Webometrics Ranking of World Universities (121 universities). Clustering was carried out on the

basis of the rating indicators "Openness Rank" (*Y1*) and "Excellence Rank" (*Y2*) from 2018 (Webometrics Ranking of World Universities, 2019). The "Openness Rank" indicator reflects the references according to figures captured from Google Scholar, while the "Excellence Rank" indicator reflects the number of papers published over the last five years that are included in 10 % of the most cited works and indexed by Scopus. The selected indicators characterize the publication activity of university professors and how frequently their works are cited. The number of citations reflects the quality of their research, which is directly related to the lecturer's competence and ability to present the material, as well as to the relevance of the research. In turn, this is a representation of mobility on the one hand and a factor influencing the quality of teaching on the other (Webometrics Ranking of World Universities, 2019).

Five clusters of universities were singled out using the efficiency criterion. The dispersion analysis (Table 1) indicates the statistical significance of the results obtained.

Table 1. Dispersion Analysis of Kazakh Universities Clustering

Variable	BetweenSS	df	WithinSS	df	F	signif. p
Y1	27.31866	4	0.663984	116	1193.162	0.00
Y2	18.25014	4	0.690201	116	766.812	0.00

In terms of the indicators (*Y1, Y2*) of clustering, the value of intergroup variance (BetweenSS) exceeded the intragroup variance (WithinSS); the calculated value of the F-criterion exceeded the tabular one (2.46) with the number of degrees of freedom df = 4; 116; and the error level (signif. p) did not exceed 0.05.

The second cluster included 95 universities (meeting the criterion (1) – see below), and the indicators *Y1* and *Y2* often had the same value, so in order to determine the distances to the center of the cluster an additional criterion was added to reflect the overall rank of the university according to the Webometrics Ranking of World Universities. Standardized values were used in the clustering process.

In order to form a sample set of research and ensure both its representativeness and sufficiency for factor and regression analyses, 30 universities were singled out that met best the criterion (1). The universities selected for the sample that met criterion (1) were distributed in proportion to the total number of universities included in the cluster. From the first cluster that included three universities (2 % of the total), one university was selected to form a sample set; from the second cluster (82 % of the total) 24 universities were selected; from the third cluster (3 %), one university was selected; from the fourth cluster (6 %), two universities were selected; from the fifth cluster (7 %), two universities were selected. The universities were clustered as follows:

First cluster: L.N. Gumilyov Eurasian National University.

Second cluster: International Education Corporation, College of International Business Academy, Atyrau Engineering and Humanitarian Institute, Humanities Technical Academy, Kazakh National Academy of Choreography, Eurasian University of Technology, University Sirdariya, University of Almaty, Kazakhstan Innovation University, Bolashak University, Astana University, Atyrau University of Oil and Gas, Central Kazakhstan Academy, West Kazakhstan Innovative and Technological University, Institute of Information and Computational Technologies, SILKWAY International University SWIT, K. Satpayev Ekibastuz Technical and Engineering Institute, Kazakhstan Engineering-Pedagogical Peoples' Friendship University, Academy of Law Enforcement Agencies Kazakhstan, O. A. Dzholdasbekov Academy of Economy and Law, Humanitarian and Technical Institute Akmeshit, Syrdarya University, Kokshetau Technical Institute of Ministry of Emergency Measures, Central Asian Academy.

Third cluster: Abay Kazakh National Pedagogical University.

Fourth cluster: Karaganda State Technical University and D. Serikbayev East Kazakhstan State Technical University.

Fifth cluster: Kazakh National Agrarian University and Kazakhstan Medical University KSPH.

The sample thus formed is representative: all groups of universities are reflected in terms of their level of performance, while the representation of these groups in the sample reflects the structure of the whole in percentage terms.

The same indicators, which served as a basis for clustering Kazakh universities, were also used to assess the impact of factors of lecturer mobility on the efficiency of their universities. Positive effect is manifested as a result of the lecturer's ability to adapt to the variability of key competencies, which are demanded form the graduates on the labor market, as well as to the variability of legislative, methodological an institutional regulation of the educational process. Among the negative effects is the excessive staff turnover that leads to smaller individual and university productivity indicators as a result of additional time taken to adapt to new conditions or to make changes in the existing process.

The list of indicators affecting pedagogical mobility is based on lecturer's characteristics that are necessary to ensure their professional mobility, and based on a generalization of relevant literature (Ahn et al., 2018; Belyakova, 2014; Biktuganov, Igoshev, 2013; Pavlenko, 2017; Teichler, 2017) (Appendix).

The proposed list of indicators characterizes lecturer competence, professional and personal qualities, as well as the organization of the educational process of universities at which they teach – all of which affect their professional mobility. This list allows for the comprehensive assessment of professional mobility, because it takes into account the qualitative characteristics of the participants in the educational process (e.g., lecturer), various relations (e.g., lecturer – student, or lecturer – management), educational environment management tools (e.g., professional conditions like legislative and internal regulatory changes), and the technical and informational support of the educational process. Scoring is used because of the lack of statistical information pertaining to the field of research.

The survey (Appendix) was assessed as internally consistent with the help of Cronbach's alpha. The "alpha if deleted" coefficient, as calculated using Statistica 12.0, was 0.91, which exceeds the threshold rate of 0.7 and suggests the survey's reliability (Dubina, 2006). The "alpha if deleted" coefficient value exceeds the average one for X7-X10, X20-X23 indicators. Their exclusion from the questionnaire would lead to its greater consistency, while narrowing down the problem under study, since the two significant factors identified by the principal component method would be lost. Since the value of the Cronbach's alpha throughout the questionnaire significantly exceeds the threshold value, the exclusion of these questions is impractical.

4. Materials and methods

The universities for questioning lecturers were selected according to the criterion:

$$arg\ min \sqrt{\sum (Y_{li} - Y_{l\mu_k})^2}, \qquad (1)$$

with Y_{li} being a standardized value of the l-th indicator (Y1, Y2), use for clustering, for the i-th university;

$Y_{l\mu_k}$ is a value of the l-th indicator for the center (μ) of k-th cluster;

$i = \overline{1,n}$, with n being the number of the universities;

$k = \overline{1,m}$, with m being the number of clusters, determined with the hierarchical clustering method.

$Y_{l\mu_k}$ values are calculated by the method of clustering of k-average using the Statistica 12.0 software based on standardized values of Y1, Y2 indicators for n universities.

A survey conducted among lecturers from the universities selected by criterion (1) for each of the clusters served as the methodological basis for obtaining quantitative assessments of the level of professional mobility. The questionnaire was voluntary in nature, which was necessary to ensure the research ethics, and was carried out via e-mail. The number of respondents (1109 lecturers of different age categories, various academic degrees, ranks, and areas of knowledge) was representative, as the minimal representative sample for the survey is 273 people. Another factor that ensured representativeness was the presence of universities from all clusters.

The structure (factors) of professional mobility and the role of the resource component were determined using principal components method. It was based on quantitative estimates obtained

as a result of the survey. The influence of factors of pedagogical mobility on the university's efficiency level was studied with the help of regression models that were constructed using the nonlinear estimation method. A standardized arithmetic mean value of the indicators Y1, Y2 was used as a dependent variable in the regression models, while values of the principle components (Fi) were used as independent variables. Due to the incommensurability of dependent and independent variables, independent variables acquire values in the range [0.02; 5.8], and dependent acquires values in the range [2203; 6721]. Dependent variable was standardized:

$$Y_i = \frac{(Y1_i + Y2_i) - \overline{(Y1+Y2)}}{\sigma_{(Y1+Y2)}}, \quad (2)$$

with Y_i being an efficiency indicator for *i*-th university;

$Y1_i, Y2_i$ being the values of *Y1* and *Y2* indicators respectively for *i*-th university;

$\overline{(Y1 + Y2)}$ are the university sample average values of the Y1 + Y2 sum;

$\sigma_{(Y1+Y2)}$ is a standard error for the university sample values of the Y1 + Y2 sum.

The values of the independent variables *Fij* are determined by the arithmetic mean value of the principle component *Fj* with respondents from *i*-th university ($j = \overline{1, n}$, with *j* being an ordinal number of the principle component and *n* being the number of significant principle components).

Clustering analysis method, principle components method and regression analysis were performed using Statistica 12.0.

5. Results and discussion

As a result of processing lecturers' profiles and on the basis of the quantitative estimates obtained by the principal component method, the following factors of lecturer professional mobility are determined (Table 2). The number of observations for factor analysis was: N = 1109.

Table 2. Factors of Lecturers' Professional Mobility at the Universities of the Republic of Kazakhstan

Factor	Indicators	Factor's proper value	Factor variance, %	Cumulative variance, %
F1 – Competence factor	X1-X6	12.58	41.78	41.78
F2 – Psychological factor	X11-X14, X16	9.24	30.69	72.47
F3 – Self-development ability factor	X9, X10, X15	4.22	14.02	86.48
F4 – Information technology factor	X7, X8	1.39	4.62	91.10
F5 – The factor of efficiency of interaction between the actors in the educational process	X20, X21	0.84	2.79	93.89
F6 – Informational mobility factor	X17, X18	0.43	1.43	95.32

F7 – The professional mobility stimulation factor	X22, X23	0.24	0.80	96.11
F8 – Software and hardware support factor	X19	0.11	0.37	96.48

The basis of professional mobility is the competence factor (F1) with 41.78 % influence on the development of lecturer professional mobility. This factor combines professional knowledge, professional skills, measured by scientific achievements (availability of education, academic degree, title, awards, publications).

The psychological factor embraces personal characteristics necessary for successful adaptation and self-realization in various situations of professional activity, contributing to professional mobility, like social activity, adaptability, creativity, and interest in pedagogical activity. Conservatism is a stimulant in the development of professional mobility, but indicator X14 (the level of conservatism) was formed in such a way that the higher its value, the lower the degree of manifestation of conservatism. Therefore, this indicator is also a stimulant in the development of professional mobility. The influence of factor F2 is 30.69 %.

The self-development ability factor includes a psychological indicator of self-development ability (X15) and activity indicators characterizing the inclination towards self-development: the presence of multi-scientific (multi-professional) competencies (X9), advanced training, internships (X10). The variance of factor F3 is estimated at 14.02 %.

The mobile information related to professional activities (X7) and modern information technologies (X8) form the information technology factor (F4) with 4.62 % variance.

The factor of efficiency of interaction between the actors in the educational process characterizes the efficiency of interaction between lecturers and students both in classroom and extracurricular activities (indicators X20 and X21 respectively). The efficiency of the organization of interaction provides faster adaptation of students and contributes to the development of mobility of students and lecturers.

Information Mobility Factor (F6) characterizes the rate of information transfer regarding changes at the university level and national level. The development of the factor contributes to the development of professional mobility as a result of increased awareness, which contributes to professional development and optimization of the educational process.

F7 factor describes the stimulation of the development of professional mobility. These are the opportunities provided by the university and incentives for the development of lecturers' professional mobility: providing the opportunity for quick adaptation (X22), promoting international mobility of lecturers (X23).

Software and hardware support factor (F8) characterizes the availability of technical means (computers, multimedia) and software products at the university level. This factor contributes to the development of professional mobility by creating appropriate working conditions, access to operational information, professional development.

The analysis of the content of factors allows to determine two components of the professional mobility of university lecturers: 1) the resource component characterizing the presence of professional, personal characteristics of lecturers, their propensity for mobility (factors F1-F4), and the availability of software and hardware for the effective organization of the educational process (factor F8); 2) the process component is associated with the efficiency of the organization of the educational process: the organization of interaction between the lecturer and the student, the lecturer and the university management, aimed at promoting mobility and adaptation of students and lecturers (factors F5-F7). The contribution of the resource component in the formation of professional mobility of lecturers is 91.46 %, while the process component has 5.01 % and unrecorded factors have 3.52 %.

According to the Kaiser criterion (Table 2) and Cattell criterion (Figure 1), factors F1-F4 are significant, as their proper values exceed 1.0 and the cumulative percentage of variance is 91.10 %, which indicates the complete factorization. Therefore, the decisive role in the development of professional mobility is played by the resource component, namely the individual (professional and psychological) characteristics of the lecturer. The influence of the process component is not statistically significant.

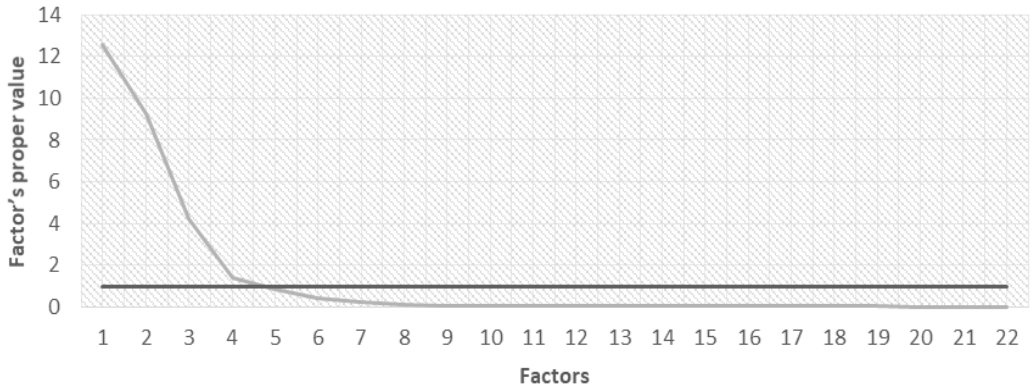
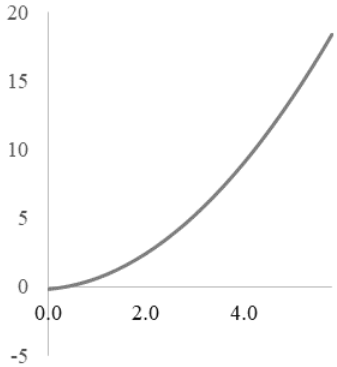
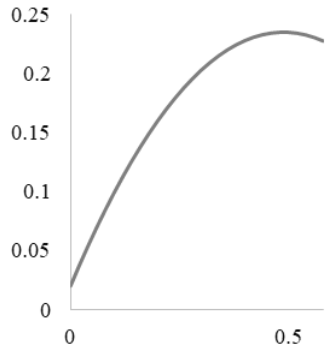


Fig. 1. The scree plot for proper values of factors of lecturer professional mobility in the Kazakh universities

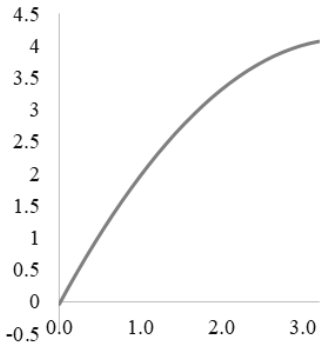
The way the dynamics of the development of factors of lecturer professional mobility influences their universities' efficiency was established by constructing one-way non-linear regression models in which Y was a dependent variable for universities, calculated by formula (2), while the independent variables were the university average values of statistically significant factors F1-F4. Thus, the number of observations was N = 30. The results of building models are shown in Figure 2.



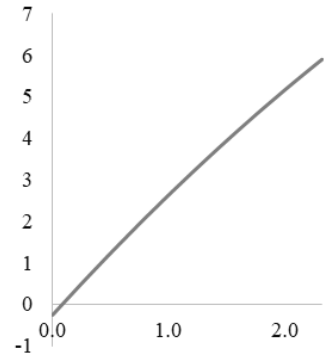
$Y = 0.5 * F1^2 + 0.3 * F1 - 0.18$
The model of factor F1 influence



$Y = - 0.9 * F2^2 + 0.88 * F2 + + 0.02$
The model of factor F2 influence



$Y = -0.33 * F3^2 + 2.34 * F3 - - 0.04$
The model of factor F3 influence



$Y = -0.18 * F4^2 + 3.07 * F4 - - 0.26$
The model of factor F4 influence

Fig. 2. Models of the influence of lecturer professional mobility development factors on university efficiency

The constructed models testify to the positive influence of all factors of professional mobility on the efficiency of the university at a given level of development. But, with an increase in the value of factors F2-F4, the increase in the efficiency indicator (Y) decreases. This indicates that there are critical values for the development of factors, which, being overpassed, would lead to a decrease in efficiency.

The following indicators prove the adequacy of the constructed models:

1) the multiple correlation coefficient with the values tending to 1: 0.92 for the function Y = f (F1), 0.96 for the function Y = f (F2), 0.90 for the function Y = f (F3), 0.94 for the function Y = f (F4);

2) a determination coefficient with values exceeding a sufficient level of 0.75: 0.85 for the function Y = f (F1), 0.92 for the function Y = f (F2), 0.81 for the function Y = f (F3), 0.88 for the function Y = f (F4);

3) F-test criterion with calculated values (16.84-29.08) exceeding the tabulated 4.20 at a significance level of 0.05.

The extreme points of the functions Y = f (F2), Y = f (F3), Y = f (F4) were obtained by finding the first-order derivative of the constructed functions (Figure 2). The extreme points corresponding to the maximum value of the resulting indicator (Y) were: F2crit = 0.49, F3crit = 3.55, F4crit = 8.53. An increase in the value of factors above critical values will lead to lower university efficiency.

Potentially possible values of factors at this stage of development of professional mobility at universities in Kazakhstan are calculated by supplementing the sample with a series of data that corresponds to the maximum score values of indicators X1-X4, X6-X23 according to the proposed assessment scheme (Table 1) and calculating the values of the main components in the program Statistica 12.0. Potential values of the factors were: F2pot = 0.53, F3pot = 3.19, F4pot = 2.32. For factor F1, the potential value was not calculated due to the absence of an upper bound on the value of the indicator X5.

As part of this study, an approach was presented to determine the factors for the development of lecturer professional mobility within the higher education system. This approach is accurate, adequate, universal in application, consistent and valid. It found that the resource component (personal and professional qualities of a person) is a driver for the development of professional mobility of lecturers in universities in Kazakhstan. These results confirm the results of earlier theories surrounding professional mobility: personality characteristics and immaterial factors (process component) are dominant in the process of developing the lecturer professional flexibility in the educational environment (Iucu et al., 2011; Zamir, 2018). But meanwhile, given the specifics of the educational system of Kazakhstan, as well as its cultural features, it should be noted that in the framework of this study, the evidence for the dominance of the resource component in the development of professional mobility is completely contrary to the point of view of scientists in Kazakhstan (Abdiraiymova et al., 2013; Malikov, 2014; Monobayeva, 2013; Gabdulina, Zhuman, 2019), as well as the main priorities of the national strategy (Official Website of the President of the Republic of Kazakhstan, 2018; Strategy 2050, 2020) to ensure the effectiveness of the higher education system. The top-priority consideration of a lecturer's personal and professional characteristics is explained by the fact that professional mobility in the pedagogical sphere has a number of features arising from the specifics of professional activity. Ensuring the flexibility and versatility of vocational education significantly enhances the development of professional mobility in the educational sphere, especially with regard to higher education. In the conditions of worldwide integration, internationalization and openness of the educational sphere, the functioning of many international grant support funds that encourage the academic mobility of lecturers and students, it is the personal factor that is the basis for the development of professional mobility regardless of the level of economic development of the country. That is, the influence of the material factor in this aspect is secondary, which is also characteristic of Kazakhstan. Consequently, the professional mobility of a lecturer is not just a declared educational strategy, but a product of time and an expression of world educational trends. The obtained results are highly relevant as the specific set of factors for the development of professional mobility of a lecturer in a higher school of Kazakhstan is determined, which will improve educational management in the country and make adjustments to the priorities of the national strategy for the innovative development of higher education. In our conditions, it seems appropriate for the improvement of the universities' efficiency to introduce various trainings on the development of university lecturers: creativity and motivation for mental flexibility, emotional control, resistance to stressors, self-confidence, self-acceptance, a positive attitude world, independence, autonomy, responsibility, motivation for self-actualization, and self-improvement. Thus, the lecturer personality formation should become the primary goal, meaning and task of any educational system and should be considered as a system-forming component.

The proposed methodological approach for determining the development factors of lecturer professional mobility also helped conclude that contrary to previous research results (Malikov, 2014; Monobayeva, 2013; Belyakova, 2014), not all factors of the resource component of professional mobility in the education field directly affect the universities' efficiency. The F1 factor's development, however, helps increase such efficiency. The F2 factor's potential value exceeds the critical value. The development of the psychological factor by more than 92.5 % of the potential level creates the opposite effect, namely a decrease in the efficiency of the functioning of the university. For factors F3–F4, critical values exceed potential ones. At this level of lecturer professional mobility development, the cultivation of the ability for self-development, as well as the informational and technological factor have a positive impact on the university's efficiency.

However, it should be noted that the results of the study were obtained only on a sample of universities in the Republic of Kazakhstan, which limits the possibility of their application in educational management practices in other countries. Moreover, in the framework of the study, the influence of the structural dimensions of the professional mobility resource component on the efficiency of higher education institutions was not considered in dynamics, and the qualitative and quantitative laws of such an impact were not identified because of their fundamental nature. Nevertheless, in view of the importance of these aspects and with the results of our study, these aspects will form the basis for further scientific developments.

6. Conclusion

The study revealed that one of the highest priorities to increase the efficiency of higher education in Kazakhstan in the context of the internationalization of the higher education system is the development of the professional mobility of university lecturers. The proposed methodological approach to determine the development factors of lecturer mobility in higher education attests to the importance of the resource component, which encompasses the personal factors, such as competence, psychological, and self-development ability, and information and technological factors that determine the development of professional mobility of the teaching staff in the universities of Kazakhstan. That is, the structure of the lecturer mobility implies the presence of new value qualities that should be formed in the educational sphere. Consequently, the professional mobility of a lecturer is not just a declared educational strategy, but a product of time and an expression of worldwide educational trends. At the same time, despite the presence of a directly proportional effect of the resource component of the lecturer's professional mobility on the efficiency of the university, the development of the self-development factor and the information and technological factors to a critical level negatively affects university efficiency.

References

Abd, Behadili, 2019 – *Abd, M.S., Behadili, S.F.* (2019). Recognizing job apathy patterns of Iraqi higher education employees using data mining techniques. *Journal of Southwest Jiaotong University*. 54(4). [Electronic resource]. URL: http://jsju.org/index.php/journal/article/view/342

Abdiraiymova et al., 2013 – *Abdiraiymova, G., Duisenova, S., Shayakhmetov, S.* (2013). Reforming of system of the higher education in Kazakhstan (based on results of sociological research). *Procedia – Social and Behavioral Sciences*. 82: 397-403.

Ahn et al., 2018 – *Ahn, E.S., Dixon, J., Chekmareva, L.* (2018). Looking at Kazakhstan's higher education landscape: from transition to transformation between 1920 and 2015. In J. Huisman, A. Smolentseva, I. Froumin (Eds.). *25 Years of Transformations of Higher Education Systems in Post-Soviet Countries* (pp. 199–227). Cham, Switzerland: Palgrave Macmillan.

Analytical report..., 2018 – Analytical report on the implementation of the principles of the Bologna process in the Republic of Kazakhstan (2018). Astana. [Electronic resource]. URL: https://webcache.googleusercontent.com/search?q=cache:zqUyzOc1rz0J:https://enic-kazakhstan .kz/uploads/additional_files_items/28/file_en/analiticheskiy-otchet-final-14-12-2018-1.pdf% 3Fcache %3D1556191390+&cd=1&hl=ru&ct=clnk&gl=ua

Appleton et al., 2006 – *Appleton, S., Morgan, W.J., Sives, A.* (2006). Should lecturers stay at home? The impact of international lecturer mobility. *Journal of International Development*. 18: 771-786.

Belyakova, 2014 – *Belyakova, N.V.* (2014). Professional mobility of teaching staff as an indicator of their success in the context of the transition to new generation standards. *Proceedings of the Annual*

International Scientific and Practical Conference "Early Childhood Care and Education". [Electronic resource]. URL: https://cyberleninka.ru/article/n/professionalnaya-mobilnost-pedagogicheskih-kadrov-kak-pokazatel-ih-uspeshnosti-v-usloviyah-perehoda-na-standarty-novogo-pokoleniya

Bense, 2016 – *Bense, K.* (2016). International lecturer mobility and migration: A review and synthesis of the current empirical research and literature. *Educational Research Review*. 17: 37-49.

Biktuganov, Igoshev, 2013 – *Biktuganov, Yu.I., Igoshev, B.M.* (2013). The formation of lecturers' mobility is a promising area of activity of the Ural State Pedagogical University. *Pedagogical Education in Russia*. 3: 6-9.

Caena, 2011 – *Caena, F.* (2011). Literature review. Lecturers' core competences: requirements and development. European Commission, Education and Training 2020, Thematic Working Group "Professional Development of Lecturers". [Electronic resource]. URL: https://ec.europa.eu/assets/eac/education/experts-groups/2011-2013/lecturer/lecturer-competences_en.pdf

Dubina, 2006 – *Dubina, I.N.* (2006). Mathematical foundations of empirical socio-economic research. Barnaul, Russia: Publishing House of the Altai University.

Durkheim, 2014 – *Durkheim, E.* (2014). The Division of Labor in Society. New York, NY: Simon & Schuster, Inc.

European Commission DG Education and Culture, 2020 – European Commission DG Education and Culture (2020). Common European principles for lecturer competences and qualifications. [Electronic resource]. URL: http://www.pef.uni-lj.si/bologna/dokumenti/eu-common-principles.pdf

Gabdulina, Zhuman, 2019 – *Gabdulina, A., Zhuman, G.* (2019). Higher education in Kazakhstan. *Espacios*. 40: 2.

Garam, 2007 – *Garam, I.* (2007). International lecturers mobility. Benefits and impact in comprehensive and upper secondary schools, vocational education and training and higher education. CIMO. [Electronic resource]. URL: http://cimo.innofactor.com/instancedata/prime_product_julkaisu/cimo/embeds/cimowwwstructure/15628_lecturer_mobility_summary_2007.pdf

Government of the Republic of Kazakhstan, 2020 – Government of the Republic of Kazakhstan (2020). Issues of the Ministry of Education and Science of the Republic of Kazakhstan. [Electronic resource]. URL: https://online.zakon.kz/document/?doc_id=1051308#pos=4;-88

Iucu et al., 2011 – *Iucu, R., Pânişoară, I.-O., Pânişoară, G.* (2011). The professional mobility of lecturers – new tendencies in the global society. *Procedia – Social and Behavioral Sciences*. 11: 251-255.

Jumakulov, Ashirbekov, 2016 – *Jumakulov, Z., Ashirbekov, A.* (2016). Higher education internationalization: insights from Kazakhstan. *Hungarian Educational Research Journal*. 6(1): 35-55.

Jusuf et al., 2020 – *Jusuf, E., Herwany, A., Kurniawan, P.S., Gunardi, A.* (2020). Sustainability concept implementation in higher education institutions of Indonesia. *Journal of Southwest Jiaotong University*. 55(1). [Electronic resource]. URL: http://jsju.org/index.php/journal/article/view/488

Lipset, Bendix, 2018 – *Lipset, S., Bendix, R.* (2018). Social mobility in industrial society. Berkeley, CA: University of California Press.

Malikov, 2014 – *Malikov, A.* (2014). External academic mobility of faculty in one regional university in Kazakhstan: challenges and opportunities. Nur-Sultan, Kazakhstan: Nazarbayev University Graduate School of Education.

Mihut et al., 2017 – *Mihut, G., Altbach, P.G., de Wit, H.* (2017). Understanding global higher education: insights from key global publications. Rotterdam, Netherlands: Sense Publishers.

Monobayeva, 2013 – *Monobayeva, A.* (2013). Internationalization of higher and postgraduate education in Kazakhstan: focus on business education. *International Journal of eBusiness and eGovernment Studies*. 5(1): 23-32.

Official Website of the President of the Republic of Kazakhstan, 2018 – Official Website of the President of the Republic of Kazakhstan (2018). President Nazarbayev's message to the people of Kazakhstan. [Electronic resource]. URL: https://www.akorda.kz/ru/addresses/addresses_of_president/poslanie-prezidenta-respubliki-kazahstan-n-nazarbaeva-narodu-kazahstana-10-yanvarya-2018-g

Patrinos, Angrist, 2019 – *Patrinos, H.A., Angrist, N.* (2019). Harmonized learning outcomes: transforming learning assessment data into national education policy reforms. World Bank Group.

[Electronic resource]. URL: http://blogs.worldbank.org/opendata/harmonized-learning-outcomes-transforming-learning-assessment-data-national-education

Pavlenko, 2017 – *Pavlenko, M.* (2017). The problem of developing professional mobility of lecturers in the works of foreign scholars. *Comparative Professional Pedagogy*. 7(4): 132-138.

Seitzhanova et al., 2015 – *Seitzhanova, A., Plokhikh, R., Baiburiev, R., Tsaregorodtseva, A.* (2015). English as the medium of instruction: modern tendency of education in Kazakhstan. *Internationalisation in Higher Education: Management of Higher Education and Research. PRADEC Conference Proceedings*. 74-77.

Shegda, 2016 – *Shegda, A.* (2016). Educational factors providing professional mobility of workers. *Economics & Education*. 1(1): 50-52.

Steffy et al., 1999 – *Steffy, E.B., Wolfe, M.P., Pach, S., Enz, E.* (1999). Life cycle of the career lecturer. Thousand Oaks, CA: Corwin.

Strategy 2050, 2020 – Strategy 2050 (2020). The message of the Republic of Kazakhstan's president, the nation leader N.A. Nazarbayev "Strategy "Kazakhstan – 2050". New political course of the established state". [Electronic resource]. URL: https://strategy2050.kz/ru/page/multilanguage/

Teichler, 2017 – *Teichler, U.* (2017). Internationalisation trends in higher education and the changing role of international student mobility. *Journal of International Mobility*. 5: 177-216.

Usembayeva et al., 2016 – *Usembayeva, I.B., Ramankulov, Sh., Berdi, D.K., Saparbekova, B., Ualikhanova, B.* (2016). Procedure of implementation the applied orientation of future lecturers training using ICT. *American Journal of Applied Sciences*. 12(9): 636-643.

van der Aa et al., 2019 – *Van der Aa, J.E., Scheele, F., Goverde, A.J., Teunissen, P.W.* (2019). A qualitative study on harmonization of postgraduate medical education in Europe: negotiating flexibility is key. *Perspectives on Medical Education*. 8(4): 216-222.

Vitenko et al., 2017 – *Vitenko, T., Shanaida, V., Droździel, P., Madleňák, R.* (2017). Trends and features of internationalization of higher education as a major factor of higher educational institutions development. *Proceedings of the 9th International Conference on Education and New Learning Technologies*. 7458-7463.

Webometrics Ranking of World Universities, 2019 – Webometrics Ranking of World Universities (2019). Ranking web of universities. Kazakstan. [Electronic resource]. URL: https://www.webometrics.info/en/Asia/Kazakstan

Woldegiyorgis, 2018 – *Woldegiyorgis, A.A.* (2018). Harmonization of higher education in Africa and Europe: policy convergence at supranational level. *Tuning Journal for Higher Education*. 5(2): 133-157.

Yazan, 2018 – *Yazan, B.* (2018). A conceptual framework to understand language lecturer identities. *Journal of Second Language Lecturer Education*. 1(1): 21-48.

Zamir, 2018 – *Zamir, S.* (2018). A teaching career: mobility and stagnation. *Athens Journal of Education*. 5(2): 145-160.

Zeer, 2014 – *Zeer, E.F.* (2014). Students' social and professional mobility as a prerequisite of dynamic career prospects. *The Education and Science Journal*. 8: 33-48.

Appendix

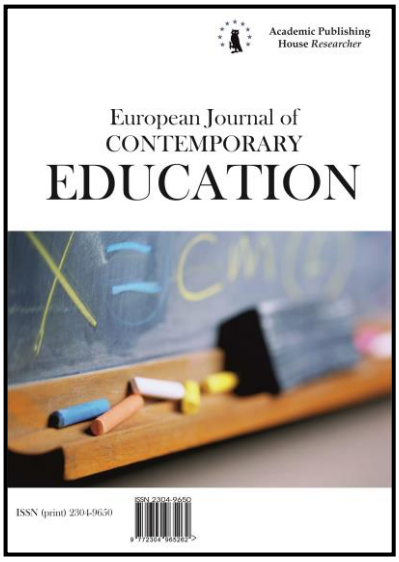
Table 1. Systematization of Indicators Affecting Lecturer Professional Mobility in the Higher Education Institutions of Kazakhstan

Designation	Indicator	Estimation
Questionnaire		
X1	The basic higher education in the expert area	0 – Yes, I have one; 1 – I don't have one
X2	Academic degree	0 – I don't have one; 1 – I am a Candidate of Sciences; 2 – I am a Doctor of Sciences
X3	Academic title	0 – I don't have one; 1 – I am a senior lecturer;

		2 – I am a professor; 3 – I am a member of the Academy of Sciences
X4	Awards for scientific and pedagogical activity	0 – I don't have any; 1 – I have regional awards; 2 – I have national awards; 3 – I have international awards
X5	Publications in Scopus and WoS journals	The number of publications (0 if there are no)
X6	Knowledge of a foreign language	0 – I don't know any; 1 –A2 level; 2 – B1 level; 3 – B2 level; 4 – C1 level; 5 – C2 level
X7	Tracking legislative changes in education and specialization	0 – I'm not interested; 1 – I have some information from colleagues and friends; 2 – I monitor these issues, but maximum once a month; 3 – I regularly monitor these issues
X8	Skills in modern information technology	0 – at a simple level; 1 – the basic software (for example, MSOffice); 2 – use of modeling software in professional activities
X9	The multi-scientific (multi-professional) competencies	0 – narrow area of expertise (1-2 disciplines); 1 – expertise in all disciplines within one specialist area; 2 – expertise in cognate disciplines; 3 – knowledge and skills in various fields
X10	Further training and internship	0 – advanced training in established terms; 1 – active professional development (more often than prescribed) within the country; 2 – active professional development, including abroad
X11	Social commitment	5-point scale with 0 being the lowest level of social commitment and 5 being the highest level of social commitment
X12	Adaptability level	5-point scale with 0 being the lowest level of adaptability and 5 being the highest level of adaptability
X13	Creativity level	5-point scale with 0 being the lowest level of creativity and 5 being the highest level of creativity
X14	Conservatism level	5-point scale with 0 being the lowest level of conservatism and 5 being the highest level of conservatism
X15	Self-development ability	5-point scale with 0 being the lack of ability for self-development and 5 being the remarkable ability for self-development
X16	Interest in teaching	5-point scale with 0 being the lack of interest in teaching and 5 being the active interest in teaching
Questions about the educational process at the university		
X17	Timely informing of the scientific and pedagogical staff	0 – within more than 1 month; 1 – within 1 month;

	at the university level (department, dean's office) about changes in internal regulatory documentation	2 – within more 2 weeks; 3 – within more 1 week; 4 – within 1-2 days
X18	Timely informing of the scientific and pedagogical staff about changes in the legislation relating to the professional or organizational activities of the lecturer	0 – no information; 1 – within more than 1 month.; 2 – within 1 month; 3 – within more 2 weeks; 4 – within more 1 week; 5 – within 1-2 days
X19	Sufficient supply of technical means (computers, multimedia) and software products	0 – no opportunity to use computers; 1 – lack of technical equipment; 2 – provision with technical means, but without the ability to work with professional software products; 3 – availability of technical equipment with the ability to work with professional software products
X20	The efficiency of the organization of interaction between lecturers and students in classroom work	5-point scale with 0 being the lowest level of efficiency and 5 being the highest level of efficiency
X21	Efficiency of organization of interaction between lecturers and students in extracurricular activities	5-point scale with 0 being the lowest level of efficiency and 5 being the highest level of efficiency
X22	Providing the ability to quickly adapt staff and students	5-point scale with 0 being the lowest level of adaptability and 5 being the highest level of adaptability
X23	Promotion of international mobility of lecturers (participation in international conferences and continuing education programs, promotion of international publications)	5-point scale with 0 meaning the absence of any encouragement and 5 meaning the presence of material and non-material encouragement

Published in the Slovak Republic
European Journal of Contemporary Education
E-ISSN 2305-6746
2020, 9(3): 505-519
DOI: 10.13187/ejced.2020.3.505
www.ejournal1.com



Attitudes Towards Social Responsibility Among Faculty Members of the Hashemite University

Omar T. Al-batayneh [a], Zohair Hussein Al-Zoubi [a, *], Rana Mohammad rawashdeh [a]

[a] Faculty of Educational Sciences, Hashemite University, Zarqa, Jordan

Abstract

The study aimed to identify the level of social responsibility among the faculty members of the Hashemite University, from their point of view, and also aimed identify if there any statistically significant differences in the level of social responsibility due to faculty (humanities and science), academic rank (tutor, assistant professor, associate professor, and professor), and years of experience (less than 5 years, 5-10 years, 11-20 years, and more than 20 years). The sample consisted of 274 faculty members, and the study was conducted in the academic year 2018/2019. The methodology was a questionnaire containing a total of 44 items under the headings of self-responsibility, collective responsibility, religious moral responsibility, and national responsibility. After analyzing the data, the results showed that the level of social responsibility among the faculty members was ranked as 'average', with the order of the four dimensions as follows: moral and religious responsibility was ranked highest, followed by national responsibility, self-responsibility, and finally, collective responsibility all with an average level. The results also showed that there were no statistically significant differences in the level of social responsibility by faculty, academic rank, or years of experience. The authors' recommendation to benefit from faculty members' consultancy in the university and in different disciplines.

Keywords: social responsibility, faculty, Hashemite university.

1. Introduction

In the past, institutions operated freely without regard to the various effects and implications they might have on the environment in which they operated, whether internally or externally. However, the widespread scientific and technological developments of today's business environment, and the transition of societies to the knowledge economy or digital economy, clearly indicate the important role that business plays in various sectors worldwide(Abed-Baqir, 2012).

* Corresponding author
E-mail addresses: zohair971@yahoo.com (Z. Hussein Al-Zoubi), Rawashdeh_rana@yahoo.com (R. Mohammad rawashdeh)

Large enterprises are competing with their inventions and discoveries, whether in goods or services. The impact of these organizations has influenced national governments at various levels, all under the heading of social responsibility (Diafi, 2010).

Social responsibility is defined as what a person is responsible and attributable for, including things and actions he has done, social responsibility has three dimensions. First, the economic dimension is based on the principles of competition and technological development. It includes a wide range of elements of social responsibility that must be taken into account within the framework of respect for fair and free competition rules and the full benefit of technological development that does not harm society or the environment (Al-Gali, Al-Ameri, 2009). Second is the social dimension: the institution must contribute to the well-being of the society in which it operates and improve and care for the affairs of its employees; this is reflected positively in these institutions and societies by increasing their productivity, developing their capabilities, and providing professional and occupational security, healthcare, and community care (Samadi, Athmnih, 2008). Third is the environmental dimension: the organization must take into account its environmental impact, and work to contribute to the elimination of toxic emissions and waste, to maximize efficiency and productivity from available resources, and to reduce practices that may negatively affect the enjoyment of the countryside and future generations of these resources (Shaheen, 2011).

Several indicators are used to measure the level of social responsibility: social indicators, social performance indicators for the organization's workers, and social performance indicators (Hilalo, 2013).

Social responsibility is based on several principles: environmental reform and protection, values and ethics, accountability, strengthening and enhancing authority, financial performance and results, workplace specifications, collaborative relationships, quality products and services, and community engagement (Al-Hassan, 2014). If it is difficult to define the concept of responsibility for companies, it is more difficult to agree on the definition of responsibility for universities (Rahal, 2011).

The issue of social responsibility of universities is not new, but it is currently presented globally as a concept that must be highlighted and incorporated firmly in the curricula, roles and outcomes of universities. This means that all educational institutions, including universities, must place social responsibility at the heart of their strategies, as in all other institutions in society (Mohammed, 2016). Universities have a key role in addressing the problems and challenges facing society and finding solutions by following the scientific method and by conducting specialized studies and research (Al-Rawashada, 2011). Graduates have been provided with the values, skills and knowledge to carry out their various community roles (Amer, 2007); this calls for ascertaining the nature and quality of the contribution of the higher educational institutions to these attributes, especially relating to citizenship, tolerance, dialogue, acceptance of others, creative thought and morality (Rahal, 2011).

The social responsibility of universities thus has two major aspects. First is commitment, that is the involvement and empowerment of the various members of the university community to performing their social responsibility. Executing social responsibility cannot occur in isolation or by a specific group of people, but must be consistent with the overall mission of the institution (Shaldan, 2014). Second is self-diagnosis, conducted by universities in order to evaluate their status in terms of strengths and weaknesses, and identify areas for improvement. They have to analyze the existing conditions to determine their level of social responsibility. This self-diagnosis is carried out by various members of the community, both internally by academic staff and students, and externally by community members, government officers, graduates, suppliers and others (Keita, 2016). Investigation and implementation involve the communication of the self-diagnostic results among all participating groups, both internal and external. The data can be summarized as strengths and weaknesses, critical points, and demands/suggestions. The summary of key results and proposals for improvement can be presented through talks, meetings, reports, brochures, official presentations, etc. (Fedrico, 2012: 24).

The social responsibility of academics has national, human, social, and ethical dimensions and implications, and requires each of them to perform their duties to the fullest in teaching, scientific research, community service and development (Al-Thaity, 2015). From the first post as a researcher, the scientific method must play a crucial role in solving the problems of society and

meeting the needs and aspirations of its members (Ahuandu, 2016). Nevertheless, if scientific research remains confined within the framework of the university and is used for purely personal purposes such as promotion and obtaining personal or material gains, as in the case in many third-world countries, then the academic's role is transformed from a producer of scientific knowledge that would be beneficial to society to a mere employee who is considered a stranger to society, unable to respond to the challenges facing society or to bring about any reform or change to the real world (Al-Shafei, 2016).

The participation of citizens, particularly active ones such as members of civil society organizations, in prioritizing studies and research brings a number of benefits and gains for both the researchers and society, such as promoting the values of participation, interaction, dialogue, the sense of responsibility and a sense of belonging (Al-Otaibi, 2013). Therefore, the involvement of citizens in the process of scientific research will strengthen the sense of belonging to society, and will reflect the values of citizenship (Al-Buasir, 2017). Sharing the results of research with citizens will eventually raise their awareness of the studies' results, and increase their interest in participating and enthusiastically approaching these work (Al Khattab et al., 2015). The partnership between universities and the local community provides the researcher with the opportunity to gain various insights, ideas and experiences to recognize the fact that many thinkers and visionaries and those with practical experience are outside the walls of the university. Therefore, seeking help from them, or giving them the opportunity to become involved in studies, reinforces the principle of community conscience or social responsibility (Arando, 2016).

The university faculty member is considered the driving force of research through scientific method and ability, with active participation in the sensitivity and study of social problems (Shaheen, 2011). The researcher must propose solutions and alternatives to deal with these problems, apply the results of studies in different fields of life, work regularly to improve his own performance and scientific knowledge and expertise, increasing the knowledge in his field of specialization, and disseminating it through attending conferences and seminars (Al-Fahid, 2012). The researcher's target is to develop and benefit society, not solely to obtain a degree (Hamdan, 2011).

The knowledge society requires that faculty members have appropriate conditions/that encourage them to research, develop and teach effectively (Awad, 1999). However, the current reality is that many obstacles prevent faculty members from fulfilling their roles in accordance with the requirements of knowledge (Najdat, 2010).

This is confirmed by studies monitoring the major obstacles preventing faculty members from performing their roles. For example, performance constraints in the educational process include a gap between the university's preparation of students and the requirements of the labour market, and lack of consideration of the tendencies and abilities of students when accepting them at university. There are also performance constraints in the field of scientific research (Al-Hammouri, 2013), which include the lack of a policy to market the results of scientific research, and the inadequate provision of laboratories, services and equipment (Ruweished, 2007). The barriers to community service include the few incentives encouraging faculty members to serve the community, and the lack of quantifiable means available to the university to participate in community services. Finally, there are personal constraints affecting the performance of faculty members, including insufficient salaries to achieve a decent standard of living, and poor services provided by the faculty club to its members (Al-Gali, Al-Ameri, 2005).

Without doubt, these constraints have a significant impact on the preparation and composition of faculty members among the knowledge society, which requires them to be always informed of the latest research and studies. This will not happening the light of their low incomes, the absence of appropriate university services, and the presence of many of the obstacles outlined above.

The concept of social responsibility has been addressed by many researchers, including Samadi (2009) who found that Jordanian universities in the Northern region exercise social responsibility at different levels, ranging from high to medium degree. Abdul Latif (2010) found several individual factors that help universities to perform their social role and their social responsibilities, including partnerships with governments, the private sector, business and civil society. The university should have programmers and activities that reflect its responsibility towards society. The study by Najati (2011) conducted on the top ten universities in the world

found that these universities have a great interest in the area of social responsibility, and that they provide sufficient information about the services in which they are involved. Abed-Baqir's (2012) study found that teachers do not suffer from a lack of social responsibility and there are no differences between males and females regarding their role. Shaldan (2014) has showed that the social responsibility of the Islamic University was high, but that there were differences by faculty, although not by the age or gender of faculty members. Al-Thaity (2015) study showed that the departments of educational management in Saudi universities achieved social responsibility through academic programmers and scientific research, with an emphasis on solving the difficulties and problems facing them in achieving social responsibility. Keita (2016) also showed that a modern curriculum has a prominent role in promoting social responsibility in general. Ahandu (2016) found that the quality of social responsibility depends on its planning, spreading its culture, and promoting teamwork. Al-Shafi's (2016) study revealed that the level of availability of social responsibility in educational sectors in the Gaza Strip is high, with a relationship between democratic leadership and social responsibility. The Al-Basir Study (2017) found that the deans of Imam Mohammed Bin Saud Islamic University colleges are highly aware of the difficulties in activating social responsibility in their colleges. Moumni and Maani (2017) indicated that the level of social responsibility among students of the University of Jordan was average, and that there are differences in its degree according to specialization, the family's place of residence, or the practice of parents for volunteering.

Research problem and questions

There is no doubt that the social responsibility of faculty members is great in light of dynamic and life changes. They are required to assume responsibility towards their society in respect of its skills and knowledge, defending its traditions and interacting with its problems; this responsibility must extend beyond the walls of the university, and question its own teaching. Hence this study aims to identify the level of social responsibility of the members of faculties of the Hashemite University.

The current study therefore seeks to answer the following questions:

Question 1: What is the level of social responsibility among the faculty members of the colleges of the Hashemite University?

Question 2: Are there differences in the level of social responsibility by college, academic rank, and years of experience?

Objectives of the study

This study aims to:

1. Identify the level of social responsibility of the faculty members at the Hashemite University, from their point of view.
2. Identify differences in the level of social responsibility between members of the humanities and science faculties.
3. Trace differences in the level of social responsibility between faculty members, according to academic rank.
4. Show differences in the level of social responsibility between faculty members according to their years of experience.

Importance of study

The importance of this study has both theoretical and practical aspects. In terms of theoretical importance, it tries to identify the level of social responsibility among faculty members at the Hashemite University faculties, and is unique in its approach to variables such as college, academic rank and years of experience. In terms of practical importance, it provides a tool for researchers to conduct related studies, applying the tool in other environments. It supplies sufficient scientific information that is crucial to the senior managements of higher education institutions in the formulation of instructions supporting the concept of social responsibility.

Terms of the study

Social responsibility: is the individual's self-commitment to the community, the concern it entails, the attempt to understand its problems, and to participate with it in the achievement of a task, sensing the needs of the community and other groups to which it belongs (Al-Athama, Samadi, 2009).

Faculty member: The Jordanian State Universities Act of 2001 defined the faculty as a professor, associate professor, assistant professor, teacher, and assistant teacher. A faculty member must have obtained a university degree or professional qualification in his field of specialization, be able to carry out university work, especially teaching, be medically and physically competent, and not have been convicted of any felony or misdemeanor against public honor and morality.

Hashemite University: established in 1995, and located in the city of Zarqa, central province. It is composed of 19 colleges and in the academic year 2018/2019 had a total of 28,000 students and 609 faculty members.

Limitations of the study

The study is limited to faculty members at The Hashemite University employed in the second semester of the academic year 2018/2019. The results of this study are determined by the validity and consistency of the tools used.

2. Methodology

Population

The study population is made up of the 609 faculty members of the Hashemite University, divided among19 faculties, during the second semester of the academic year 2018/19. The study scale were distributed to (309) faculty members, which is half of the study population, however, 35 tools were excluded due to incomplete data. The sample consists of 274 faculty members chosen at random from all faculties of the university, representing some 45 % of the whole population. Table 1 shows the distribution of sample members by the selected variables.

Table 1. Distribution of the study sample

Variable	Category	Frequency	%
College	Humanities	129	52.9
	Sciences	145	47.1
Academic rank	Teacher	23	8.4
	Assistant Professor	76	27.7
	Associate Professor	90	32.8
	Full Professor	85	31.1
Years of Experience	Less than 5 years	61	22.2
	5-10 years	84	30.6
	11-20 years	77	28.1
	More than 20 years	52	19.1
Total		274	%100

Instrument

A questionnaire measuring the social responsibility of faculty members was designed based on previous research, including Abdul Latif (2010), Hello (2013), Saldan & Saima (2014), Al-Bayti (2015), Al Khattab (2015), Muhammad(2016), and Al-Basir (2017). It was initially formed in two parts: Part 1 included the variables: college, academic rank, years of experience. The second part comprised 44 items divided into four dimensions: self-responsibility (8), collective responsibility (12), religious and moral responsibility (10), and national responsibility (14).

Performance validity

In order to verify its credibility the questionnaire was presented to ten faculty members of the Hashemite University and the University of Jordan for their opinions on the integrity of the items and their dimensions in terms of their scientific accuracy and language formulation. Six of the original 50 items were deleted, leaving 44, and others were amended. The A 5-point Likertscale was used to measure responses: 5 = very large, 4 = large, 3 = average, 2 = weak, and 1 = very weak.

Reliability

The stability factor of the instrument was calculated using the test-retest method; a preliminary sample was distributed to 30 faculty members who were not counted in the main study. Two weeks later, the test was reapplied to the sample itself. After checking the answers, recording the grades and finding the relationship between the first and second tests using Pearson's uncertainty coefficient, the internal consistency was found to be was statistically significant(Cronbach's Alpha 0.93). See Table 2.

Table 2. Reliability(test-retest) and Cronbach's Alpha

Dimensions of social responsibility	Cronbach's Alpha	test-retest
Self-responsibility	.89	.85
Collective responsibility	.91	.86
Religious moral responsibility	.88	.87
National responsibility	.88	.89
Overall average	.93	.91

Procedures

After verifying the credibility and stability of the instrument, and identifying the study community and sample, the questionnaire was distributed to the faculty members in the departments of the various colleges. The researchers explained to the sample members the purpose of the study, and the method of answering it. They emphasized the confidentiality of the data, which was purely for scientific research purposes.

Statistical methods

In order to answer the first research question, the means and standard deviations of the scores were extracted. The T-test was used in addition to the mono-contrast analysis test to answer the second question.

3. Results

Question 1: What is the level of social responsibility among the faculty members of the Hashemite University colleges?

The results are listed in Table 3.

Table 3. Means and standard deviations for the responses to the social responsibility dimensions

N	Dimension	Rank	Mean	Standard deviation	Level of social responsibility
1	Self-responsibility	3	3.59	0.72	Moderate
2	Collective responsibility	4	3.41	0.74	Moderate

3	Moral and religious responsibility	1	3.77	0.65	High
4	National responsibility	2	3.61	0.69	Moderate
5	Overall mean dimensions		3.61	0.55	Moderate

The level of social responsibility for each dimension and overall was moderate. The total arithmetic average of social responsibility dimensions was 3.61 out of 5, and the mean for the dimensions ranged from 3.41 to 3.77.

The ranking of the dimensions was as follows: religious and moral responsibility scored 3.77, national responsibility was second at 3.61, self-responsibility was third at 3.59, and fourth was collective responsibility at 3.41.

An explanation is the fact that social responsibility plays an important role in the stability of life for individuals and communities. It protects society, upholds its laws and limits forms of abuse. Each individual performs his duty and responsibility towards himself and his community, and works in order to reflect his honesty, which is his responsibility. Since the individual is like a cell in the body of society, the body is not healthy unless all its cells are safe and perform their tasks, responsibilities and duties. Faculty members should always be models to be followed by students and the community. These results agree with those of Al-Samadi (2009), Al-Thabeti (2015), Space (2016) and Al-Basari (2017).

The following section discusses the individual dimensions of social responsibility.

Self-responsibility

The results for each item in this dimension are presented in Table 4.

Table 4. Means and standard deviations for items on the level of self-responsibility

N	Phrase	Order	Mean	Standard Deviation	Evaluation
1	When I do a job, I do my best	5	3.52	0.90	Moderate
2	I am happy to be invited to solve problems in my family	6	3.50	1.07	Moderate
3	I care for the books I borrow from the library and return them without any damage	2	3.58	1.12	Moderate
4	It worries me to get to the lecture late	3	3.57	1.16	Moderate
5	I sacrifice some of my rights for the happiness of my family	7	3.44	1.05	Moderate
6	I believe in the saying “after me, the flood”	8	3.33	1.08	Moderate
7	When I borrow books from the university library, I return them on time	1	3.59	0.99	Moderate
8	I specify time for reading and self-education	4	3.56	1.12	Moderate
Overall average			3.59	0.72	Moderate

The responses were all at the moderate level, with a mean value of 3.59 and a range of 3.33 to 3.59. The item "When I borrow books from the University Library, I return them on time", scored the highest (average of 3.59), and the "After me the flood" item the lowest (3.33).

This is because the participation of the individual with colleagues is dictated by attention and the understanding of what is required to help the group achieve its objectives. When a member accepts these criteria, he serves, guides, and masters its affairs, and participates in showing the individual's abilities and highlighting his position. The self-responsibility of a faculty member relies on him understanding and accepting his social role and performing it in light of the criteria specified. His active participation in team work accomplishes the goals fully, limited only by the collective behavior's of the group. This evaluative participation is directive and corrective at the same time.

Collective responsibility

The results for each item are presented in Table 5.

Table 5. Means and standard deviations for the items on the level of collective responsibility

N	Phrase	Order	Mean	Standard Deviation	Evaluation
1	I join my colleagues in talking about community problems	8	3.38	1.02	Moderate
2	I like to participate in group discussions	1	3.57	0.99	Moderate
3	I love participating in the funerals of martyrs	9	3.36	1.00	Moderate
4	I adhere to the university's laws and regulations constantly	2	3.53	0.99	Moderate
5	I prefer to work in a group than to work alone	10	3.33	1.01	Moderate
6	I would like to participate in volunteer work	3	3.50	0.90	Moderate
7	Cooperation is essential to the success of any group	11	3.32	0.90	Moderate
8	I believe that the leader of any group is solely responsible for its actions	4	3.48	0.99	Moderate
9	I participate in collecting donations to help those in need	5	3.44	1.00	Moderate
10	Maintaining group values is essential	7	3.39	0.98	Moderate
11	I make sure that my behaviour is acceptable to my colleagues and society	12	3.25	1.01	Moderate
12	I complete my university research and reports on time	6	3.45	1.06	Moderate
Overall Average			3.41	0.74	Moderate

The level of collective responsibility had an overall average of 3.41, with individual items ranging from 3.25 to 3.57. The item "I would like to participate in collective discussions", was ranked first (3.57), and "I make sure that my behavior is acceptable to my colleagues and society last (3.25).

This is because the faculty member has an emotional attachment to the community and is concerned for its integrity, cohesion, continuity and the achievement of its objectives. This concern

is linked to the levels of emotion with the group, which the individual involuntarily follows without choice, purpose or self-awareness. In addition to the feelings and unity shared within the group, the individual's feeling of unity with the group is important, whether good or the bad. The group is also rational, as it fills the individual's mind, thoughts and being, and becomes the subject of his consideration where he gives it a great deal of attention by studying, analyzing, and comparing it to others.

Moral and religious responsibility

Table 6 presents the results for the individual items.

Table 6. Means and standard deviations for items on the level of moral and religious responsibility

N	Phrase	Order	Mean	Standard Deviation	Level of Responsibility
1	I would like to have a collection of religious books	6	3.72	0.85	High
2	I am committed to my appointments with my colleagues	5	3.78	0.95	High
3	Apologizing to colleagues for being late to an appointment is necessary	4	3.88	0.75	High
4	I take into account the rationalization of consuming water and electricity	7	3.56	1.07	High
5	I am very careful not to throw litter on the floor	9	3.54	1.01	High
6	I am upset when I see graffiti that insults public decency	3	3.98	0.78	High
7	I work to achieve my goals regardless of the medium	10	3.50	1.00	High
8	It hurts me to see students wasting water	8	3.55	1.02	High
9	Maintaining the facilities and equipment used at the university is necessary	1	4.10	0.76	High
10	I know that religion promotes cleanliness and environmental preservation	2	4.05	0.80	High
Overall Average			3.77	0.65	High

Table 6 indicates that the level of moral and religious responsibility was high in every case and overall, with an overall mean of 3.77, and items ranging from 3.50 to 4.10. The item "Maintaining facilities and equipment that are used in the university is necessary "was ranked in first place with an average of 4.10, and "I work to achieve my goals regardless of the means" was last (3.50).

This can be explained by pointing out that the university teacher is the cornerstone of the institution, career and no university can perform its functions effectively and achieve its objectives without the availability of qualified manpower, which is expected to perform its social responsibility either individually or collectively. Thus, if higher education institutions are to achieve their goals successfully, the responsibilities of the university teacher increase; they are no longer limited to the delivery of knowledge, but now involve establishing values and spreading knowledge and skills in society.

National responsibility

Table 7 presents these results.

Table 7. Means and standard deviations for items on the level of national responsibility

N	Phrase	Order	Mean	Standard Deviation	Evaluation
1	I make sure to listen to the news	14	3.49	0.89	Moderate
2	I think that keeping public places clean is the duty of everyone in society	1	3.80	0.93	High
3	I do not care to attend political seminars	13	3.50	0.90	Moderate
4	I read about the history of my country in various aspects	2	3.71	1.05	High
5	I would like to help the owners of damaged houses	3	3.70	1.03	High
6	I do not like to read political books	12	3.52	0.90	Moderate
7	I participate in offering condolences to the martyrs	10	3.55	1.15	Moderate
8	I follow the events and changes taking place in my country	9	3.58	1.12	Moderate
9	I feel sad about any disaster occurring in my country	8	3.61	1.00	Moderate
10	I exercise my right to vote	7	3.63	0.89	Moderate
11	I am not interested in knowing how the Legislative Council works	11	3.57	0.86	Moderate
12	I make sure to show my country's Brightside	4	3.68	0.91	High
13	I participate in national celebrations	5	3.66	0.90	Moderate
14	The negativity of young people towards their homeland bothers me	6	3.64	0.88	Moderate
Overall Average			3.61	0.69	Moderate

The overall level of national responsibility was average (3.61) with mean values for individual items ranging from 3.49 to 3.80. The item "I believe that keeping public spaces clean is the duty of every person in society", was ranked high (3.80), and I make sure I listen to the news "was lowest (3.49).

This is due to the fact that social responsibility is one of the pillars of community life. It is a means of individual and collective progress, and development and human progress are also based on it. The value of the individual is measured in society by the extent to which he bears responsibility for himself and others. This is measured by his safety, mental health, and education in the development of social skills. This is one of the paths available to prepare a responsible citizen who is aware of his role towards himself and the aspects of life of his community.

The faculty member realizes that the development of social responsibility is essential to the upbringing of members of society, their raising and their preparation for life. The energy that the individual enjoys and employs in performing his duties also defends his rights at the same time. A neutral and objective person tries to find a balance between his duties and his rights, developing the sense of social responsibility that is required by mature adults. A person might feel unsatisfied when fulfilling his duties, at the same time imagining that he is not receiving all his rights. Thus, he will condemn his society with negative judgments, on the basis of which he establishes an attitude towards his society, which discourages him from any social responsibility; he abandons his conviction of a sense of social responsibility.

The faculty member is found to be following and participating in every small and large detail regarding the community and society, expressing his social responsibility towards the country and other citizens because he considers it to be at the core of his work and duty.

Question 2: Are there differences in the level of social responsibility among faculty members by college, academic rank, or years of experience?

The college

To answer this question, the t-test was used in addition to the descriptive statistics to test the four dimensions against faculty (science or humanities), as in Table 8.

Table 8. T-test results for social responsibility by college

Dimension	College	Mean	Standard Deviation	df	T	Sig
Self-responsibility	Scientific	3.72	0.68	272	-0.694	0.48
	Humanities	3.81	0.60			
Collective responsibility	Scientific	3.53	0.74	272	-0.894	0.37
	Humanities	3.65	0.69			
Religious and moral responsibility	Scientific	3.45	0.63	272	0.325	0.74
	Humanities	3.40	0.85			
National responsibility	Scientific	3.63	0.70	272	-0.445	0.65
	Humanities	3.69	0.68			
Total	Scientific	3.58	0.53	272	-0.523	0.60
	Humanities	3.64	0.58			

Statistical significance level ($\alpha \leq 0.05$)

There are no statistically significant differences between the mean values of social responsibility dimensions between colleges, since all the p-values of the calculated t-tests are larger than the alpha significance level ($\alpha \leq 0.05$).

This lack of difference by college is due to the fact that faculty members' beliefs, regardless of their college, come from the commitment to the philosophy of the university. Universities seek to exercise social responsibility through commitment to serve the community. Moreover, they formulate the academic programmers that they offer according to the needs of society; they apply research that addresses the problems of society and offer the results to the needs of society. They also link their programmers to the philosophy of sustainable human development and introduce direct social programmers in the service of communities based on human rights.

Academic rank

ANOVA analysis of the level of social responsibility according to academic rank (teacher, assistant professor, associate professor, professor) is compared for the four dimensions, as shown in Table 9.

Table 9. ANOVA results for social responsibility by academic rank

Dimension	Source	Sum of squares	df	Mean squares	F	Sig
Self-responsibility	Between groups	0.497	3	0.124	0.285	0.88
	Within groups	43.940	270	0.435		
	Total	44.437	273			
Collective responsibility	Between groups	3.323	3	0.831	1.623	0.17
	Within groups	51.695	270	0.512		
	Total	55.018	273			
Religious and moral responsibility	Between groups	1.634	3	0.408	0.738	0.65
	Within groups	55.898	270	0.553		
	Total	57.532	273			
National responsibility	Between groups	3.405	3	0.851	1.811	0.13
	Within groups	47.472	270	0.470		
	Total	50.877	273			
Total	Between groups	1.619	3	0.405	1.319	0.26
	Within groups	3 1.008	2 70	0.307		
	Total	3 2.627	2 73			

There are no statistically significant differences at the significance level ($\alpha \leq 0.05$) with regards to social responsibility according to academic rank, overallor by individual dimensions.

This is because, regardless of their academic rank, faculty members consider it their duty to participate in social responsibility with others in doing what is required, by understanding how to help the community satisfy its needs, solve its problems, reach its goals, achieve its well-being, and maintain its continuity.

Years of experience

Single contrast analysis (ANOVA) was used to measure years of experience against the four dimensions, as presented in Table 10.

Table 10. ANOVA results for social responsibility by years of experience

Dimension	Source	Sum of Squares	df	Mean squares	F	Sig
Self-responsibility	Between groups	0.497	3	0.124	0.285	0.88
	Within groups	43.940	270	0.435		
	Total	44.437	273			
Collective responsibility	Between groups	3.323	3	0.831	1.623	0.17
	Within groups	51.695	270	0.512		
	Total	55.018	273			
Religious and moral responsibility	Between groups	1.634	3	0.408	0.738	0.65
	Within groups	55.898	270	0.553		
	Total	57.532	273			
National responsibility	Between groups	3.405	3	0.851	1.811	0.13
	Within groups	47.472	270	0.470		
	Total	50.877	273			

There are no statistically significant differences at the significance level ($\alpha \leq 0.05$) with regards to social responsibility of the faculty members by years of experience, in all dimensions and overall.

This lack of statistically significant difference is because the number of years of experience represents the mindset of those who have extensive experience in their field of work. Responsibility towards students includes training, guidance, consultation and attention to the formation of positive trends towards understanding contemporary problems, while responsibilities towards the university include participating in the activities of committees, meetings and professional bodies, and representing the university in scientific and literary forums. Responsibility to the community includes serving with institutions related to the community, spreading community culture, providing consultation and conducting studies and research that address issues of interest to the community or contribute to addressing its problems, and contributing to strengthening the university's relationship with community institutions.

4. Recommendations

In light of the results of the study, it is recommended to:

- Benefit from faculty members' consultancy in the university and in different disciplines.
- Prepare university programmers and mechanisms, that direct faculty members towards their responsibilities.
- Conduct training courses for faculty members to activate social responsibility in their lives.

- Use faculty members to hold seminars and give lectures on the problems facing society.
- Work to provide the material and human resources necessary to support the role of the university in community service.
- Benefit from the research of faculty members, which should address the problems of society in all fields, i.e. economic, scientific, legal, and environmental.
- Honor faculty members who interact with society's issues and problems.
- Establish a specialized department concerned with the areas of social responsibility and work on its application and activation in the university.
- Review the academic plans and programmers of the university, so that it contains courses specialized in the development of society, linking scientific courses to the problems of society.

5. Conclusion

The social responsibility of the university professor has ethical, national and human dimensions and implication, and it requires each them to carry out his duties to the fullest in teaching process, scientific research, and in serving and the local community. The results of the current study showed that the level of social responsibility among the faculty members was moderate. The results also showed that there were no statistically significant differences in the level of social responsibility by faculty, academic rank, or years of experience.

References

Abdul Latif, 2010 – *Abdul Latif, S.* (2010). The Social Responsibility of King Saud University towards Saudi Society. A study of the university's experience in the field of environmental and community service. Paper presented to *second International Conference of the Sociology Department of the Faculty of Arts, Zigzag University*. (2): 663-691, Egypt.

Abed-Baqir, 2012 – *Abed-Baqir, N.* (2012). Social responsibility and its relationship to the functional performance of faculty members of the Faculty of Basic Education. *Journal of the Faculty of Basic Education*. 18(73): 537-657.

Ahandu, 2016 – *Ahandu, S.*(2016). Requirements for the quality of social responsibility in university education for community service. *Dirasat Journal*, 42, 46-63.

Al-Buasir, 2017 – *Al-Buasir, K.* (2017). Reality of social responsibility activation in faculties of Imam Muhammad ibn Saud Islamic University. *Journal of Scientific Research in Education*. 9(18): 511-546.

Al-Fahid, 2012 – *Al-Fahid, A.* (2012). Awareness of Security Responsibility among Saudi University Students. Unpublished Doctoral Thesis, Nayef Arab University for Security Sciences, Riyadh.

Al-Gali, Al-Ameri, 2005 – *Al-Gali, T., Al-Ameri, S. (*2005). Social Responsibility and Work Ethics. Amman: ,Wael Publishing House.

Al-Gali, Al-Ameri, 2009 – *Al-Gali, T., Al-Ameri, S.* (2009). Social Responsibility and Work Ethics. Amman: Wael Publishing House.

Al-Hammouri, 2013 – *Al-Hammouri, S.* (2013). Social responsibility: Theory and practice. Amman: Wael Publishing and Distribution House.

Al-Hassan, 2014 – *Al-Hassan, B.* (2014). The role of social responsibility in improving the organization's performance. Unpublished Master Thesis, Muhammad Khudair University, Algeria.

Al-Kattab et al., 2015 – *Al-Khattab, S., Abdullah, M., Al-Derwasha, A., Abu-Sharia, I.* (2015). The impact of social marketing and the application of social responsibility in enhancing the quality of educational services, field study on private schools and cultural centers in Maan City. *Dirasat: Management Science Studies*. 42(2): 443-460.

Al-Otaibi, 2013 – *Al-Otaibi, K. (*2013). The role of social activity in the development of social responsibility survey on pioneers of activity and high school students in Riyadh. Unpublished master Thesis, Nayef Arab University of Security Sciences, Riyadh.

Al-Rwashada, 2011 – *Al-Rwashada, A.* (2011). The role of the university in community service from the standpoint of the faculty members:Al-Balqa Applied University as a model. *Scientific Publishing Council-Kuwait University*. 40(4): 67-105.

Al-Samadi, Athamneh, 2008 – *Al-Samadi, A., Athamneh, S. (*2008). A study on constructing a scale for social responsibility among Jordanian college students. *University of Sharjah Journal for Humanities and Social Sciences*. 6(3): 273-298.

Al-Shafei, 2016 – *Al-Shafei, N.* (2016). The role of leadership styles in promoting social responsibility in the directorates of education in Gaza governorates. Unpublished Master Thesis, Al-Aqsa University, Palestine.

Al-Thaity, 2015 – *Al-Thaity, K.* (2015). Role of Saudi educational administration department in achieving social responsibility goals. *Taibahu University Journal for Educational Sciences*. 10(1): 51-67.

Amer, 2007 – *Amer, T.* (2007). Envisioning a proposal to develop the role of universities in the service of society in light of modern global trends. *Journal of the Federation of Arab Universities*. 4: 355-381.

Awad, 1999 – *Awad, A.* (1999). Social responsibility and its relationship to cognitive methods and control center. Unpublished Master Thesis, University of Assiut, Egypt.

Diafi, 2010 – *Diafi, N. (*2010). Social Responsibility of the Foundation and Human Resources. Unpublished Master Thesis, Abu Bakar BelkaidTlemcen University, Algeria.

Hamdan, 2011 – *Hamdan, M.* (2011). Problems of scientific research at private Palestinian universities and ways to overcome them from the point of view of faculty members, scientific research conference concepts, ethics, from 10-11 May Islamic University,Gaza.

Hilalo, 2013 – *Hilalo, I.* (2013). The role of Palestinian universities in the service of society in their social responsibility from the point of view of faculty members: Case study. Unpublished Master thesis, Islamic University, Gaza.

Keita, 2016 – *Keita, D.* (2016). Curriculum and its role in promoting social responsibility among students of higher education. *Journal of Psychological and Educational Sciences*. 3(2): 206-230.

Mohammed, 2016 – *Mohammed, M.* (2016). A proposed perspective for developing the social responsibility for Egyptian universities on the light knowledge society. *Arab studies in education and psychology*. 80: 407-431.

Moumni, Maani, 2017 – *Moumni, F., Maani, M.* (2017). Social responsibility and its relationship to certain environmental variables. *Journal of the Union of Arab Universities for Education and Psychology*. 15(2): 81-111.

Njadat, 2010 – *Njadat, A.* (2010). The role of Jordanian universities in promoting social and security responsibility towards their communities. Paper presented to *second international conference of the Sociology Department of the Faculty of Arts at Zagazig University*, Egypt.

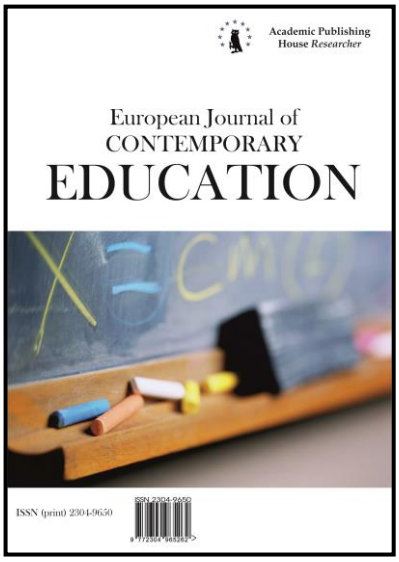
Rahal, 2011 – *Rahal, O.* (2011). Community responsibility for universities between profitability and voluntary. Paper presented to Conference on Community Responsibility of Palestinian Universities, Nablus.

Ruweished, 2007 – *Ruweished, F.* (2007). Freedom and Social Responsibility among students of the Faculty of Basic Education in Kuwait. *Journal of Educational Sciences*. First Issue, 176-20, Cairo University.

Shaheen, 2011 – *Shaheen, M.* (2011). Community responsibility for universities. Paper presented to Community Responsibility of Palestinian Universities, Nablus.

Shaldan, Sayma, 2014 – *Shaldan, F., Sayma, S.* (2014). The social responsibility of the Islamic University faculty members and the ways to activating it. *The Arab Journal for the Guarantee of The Quality of University Education*. 7(8): 149-179.

Published in the Slovak Republic
European Journal of Contemporary Education
E-ISSN 2305-6746
2020, 9(3): 520-528
DOI: 10.13187/ejced.2020.3.520
www.ejournal1.com



The Personal Agency of Modern Adolescents: Developmental Opportunities in a Socially Enriched Environment

Tatyana A. Antopolskaya [a, *], Olga Y. Baybakova [a], Alexander S. Silakov [a]

[a] Kursk State University, Kursk, Russian Federation

Abstract

The article reveals the problem of the development of personal agency of adolescents in a socially enriched environment of additional education. It deals with the theoretical aspects of the problem. Attention is drawn to significant characteristics of personal agency, such as multi-leveledness, reflexivity, motivation, initiative and realization through interaction with others. Special features of adolescence as a sensitive period for the development of personal agency are revealed.

The article provides the review of the development of personal agency of adolescents at a socially individual, socially-communicative, socially-interactive and socio-moral levels.

It describes methods of studying the development of personal agency of adolescents at a socially individual level, which fix the level of cognitive activity of adolescents and their ability for self-development, allowing to identify five stages of development of personal agency – "observer", "student", "apprentice", "master", "creator".

The results of the ascertaining stage of the experimental study of personal agency of adolescents in different educational organizations (secondary school, additional education centre) are presented. They reveal that there are certain discrepancies in the control and experimental groups both in the formation of personal agency and in the level of adolescents' need for self-development as one of the leading indicators of personal agency.

The issues of creating pedagogical conditions in the environment of additional education for the development of personal agency of adolescents are discussed. The article also substantiates the necessity of using special technologies to increase the personal agency of adolescents.

Keywords: personal agency, adolescent, social environment, socially enriched environment, additional education of children.

* Corresponding author
E-mail addresses: antopolskaya@yandex.ru (T.A. Antopolskaya), bajbakova.olga@yandex.ru (O.Y. Baybakova), alssil@mail.ru (A.S. Silakov)

1. Introduction

Modern society is exposed to the challenges that demand from a person to manifest a high level of personal agency – activity, self-support, responsibility for their life, efficiency in solving wide range of tasks. The main hopes for positive social development are associated with the younger generation now – today's adolescents, whose transformative capabilities in a few years will become an important component of human capital.

Defining the ontological foundations of personal agency, philosophers revealed a tendency to treat personal agency as a set of dimensions (Zubova, 2011: 2). Thus, L.I. Antsiferova believes that the main characteristic of personal agency is a person's awareness of himself as a source of activity, of his ability to change intentionally, within certain boundaries, both himself and the world around him (Antsiferova, 2000). At the same time, some important characteristics of a personality are concentrated in personal agency – not only activity and ability to develop, but also multi-leveledness, reflexivity, motivation, initiative and realization through interaction with others.

Scientists associate personal agency with the development of a person's ability to realize their own, individual way of carrying out activities that are optimized in relation to external and internal factors by force of self-organization of their personal capabilities (Abulkhanova, 2016). According to E.V. Bondarevskaya, the properties that mediate the level of spirituality and humanity of a person, the degree of their freedom and life creativity, are personal agency (Bondarevskaya, 2011).

In childhood, personal agency is mediated by the level of development of the child's personality, and the process of its improvement can be considered as a combination of the following factors. The first of these is the accumulation of subjective experience, and the second is the development of subjective positions through inclusion in a variety of educational activities. At the same time, the child actively interacts with himself as a person through self-knowledge, self-realization and self-determination (Selivanova, 2017). It manifests itself in the subject's ability to individual and group reflection, in the ability to make meaningful choices, in the formation of axiological paradigm (Gushchina, 2013).

Scientists consider teenage years to be a sensitive period in the formation of personal agency. It is the period of coming into being such personal characteristics as self-identity, volitional powers, a sense of maturity, and personal autonomy (Dergacheva, Leontyev, 2011). Modern adolescents belonging to Generation Z or digital generation (Soldatova et al., 2019) are distinguished by the most active use of the Internet and social networks. When designing a new virtual world for himself, a teenager acts as an active subject of information and network culture. We can say that in the teenage culture there is a "rising of the Project-oriented city" (Boltanski, 2011: 87.). Intensive online activity of adolescents, on the one hand, creates the conditions for the deformation of the real self (Fine, 2014), leads to a decrease in empathy and an increase in the subjective feeling of loneliness, on the other hand, a teenager searches for high-profile adults and peers online, interacts with them, all thus actively socializing.

From our point of view, the personal agency of a teenager is an inclusive characteristic of his personality, manifested in his ability to self-organization and self-realization and that to build effective social communications, social interaction and moral-axiological relationship with others, aimed at satisfying his activity interest in world building.

The important thing is that if a teenager has already formed personal agency as his personal characteristic, it can fulfill the function of a certain protective resource, giving him the opportunity to withstand the negative effects of the virtual environment. However, the degree of impact of the digital environment should not be exaggerated. Today we are witnessing a burst in teenagers' volunteering, taking part in good causes events, joining various associations, etc.

Recently, researchers have been paying attention to the fact that the development of personal agency ensures successful integration into society in terms of developing social communication and social interaction skills as well as socio axiological relations (Mudrik, 2016).

Moreover, for the development of personal agency, according to V.I. Panov, it is necessary to incorporate a person into an activity, which in this case is considered as the highest form of the realization of psychic activity. At the same time, a person from the subject of spontaneous activity moves to a new level, the level of the coordinator of an activity (Panov, 2018: 76).

Taking into consideration the characteristics of the personal agency of adolescents belonging to generation Z, it is possible to define the areas of activity in which their activity can manifest as

much as possible: educational and self-educational cognitive activity; social activity; communicative activity; project activities.

We suggest considering the process of development of personal agency of modern adolescents from the point of view of the development of their abilities at four levels:

- socially-individual (development of the ability to self-organization, self-understanding, self-realization and self-determination);
- socio-communicative (development of the ability to social communications, solving intra-group and external socio-communicative situations, etc.);
- socially interactive (development of the ability to organize subject-subject interactions, to analyze the experience of social interaction in real groups and social networks, to leadership in a group);
- socio-moral (development of the ability to social responsibility, to moral-axiological relations with subjects of the social environment).

Taking all the aforesaid into consideration, we can say that the understanding of personal agency in modern science has a many-valued nature. There is a need to study the process of development of personal agency of adolescents, which has its own age specificity and involves its study at different stages of formation and in different social environments.

2. Materials and methods

In this paper, we present the empirical data of the ascertaining stage of an experiment in which the socially-individual level of development of personal agency was evaluated. The examinees in the experiment were adolescents from 13 to 15 years old, attending classes at the development center of additional education "Dialog", Kursk (experimental group, hereinafter referred to as the EG), and those going to a comprehensive school (control group, hereinafter referred to as the CG). Both the EG and the CG had 50 test persons, the total number of partakers being 100.

The examinees had been chosen through matching selection according to observational criteria: gender, age, academic performance. The examinees who studied in small groups in creativity centre “Dialogue” were found a match among pupils attending the same comprehensive school chosen from the enlisted pupils by method of random selection. That defined the limitations of samples.

We hypothesized that adolescents studying in an institution of additional education have more vivid subjectivity indicators compared to those students who study in a comprehensive school. An empirical study was conducted using two techniques. One of them – the questionnaire "Assessment of the stages of formation of personal agency" (V.I. Panov et al., Modification of T.A. Antopolskaya), allows you to identify the degree of personal agency of the adolescent put into the education system, takes into account the five stages of development of subjectivity – the "Observer", “Student”, “Apprentice”, “Master”, “Creator”. At the same time, personal agency is manifested as the possibility of independent action planning, setting goals, evaluating their propriety and effectiveness.

The technology of personal agency development in socially oriented activities was applied to adolescents from the experimental group:

Stage 1 – introducing a teenager to socially oriented activities and involving them in social tests. At the same time, the teenager acts as the “Observer” of the actions and behavior patterns of the teacher, but does not proceed with the activity itself. The teaching staff provides an opportunity for adolescents to get acquainted with socially oriented projects through studying the website of the institution and pages on social networks. They organize a great variety of events: from traditional “open doors” to festivals, holidays, special events, flash mobs, presentations, etc. A teenager takes part in the arrangements as a spectator with the right to enter into a dialogue at an event organized for him in order to create conditions for the manifestation of personal agency as an emotional acceptance of the event and motivation (at this stage – a cognitive focus on a particular activity, which is verbally expressed by the phrase: "I would like to do ....").

Stage 2 – a teenager has an idea of how to interact with social objects. The teenager displays activity only through an external example or stimulus of the teacher. Emotionally positive for social objects. This is the position of the Student. The student phase involves organized interaction with other adolescents under the clear guidance of an adult leader. The teenager participates in socially

significant projects, following the instructions given to him. He is a member of the team, but so far he is mastering the chosen activity, developing skills, actively participating in trainings and educational intensive courses. The personal agency of the adolescent at this stage is supported by the pleasure from getting knowledge, acquiring skills and abilities and is verbally expressed by the phrase: "I can, I can ...".

Stage 3 – the implementation of selected socially significant activities, participation in projects, promotions, going beyond the boundaries of your institution, and active interaction according to the “teenagers-teenagers” model. This is the “Apprentice” position. Yesterday's student receives leadership rights in a small group. He continues to follow the instructions of the leader (not necessarily the teacher). However, these assignments require the team work of a small group. The personal agency of "Apprentice" is expressed in the ability to make their own decisions to achieve their goals. Verbally personal agency of an Apprentice is expressed by the phrase: "I make decisions, I am responsible for their consequences, I am ready to achieve results together with my team." The activity of the adolescent at this stage is supported by the approval of the leader and success in the implementation of instructions in the process of CO-action, CO-experience.

Stage 4 – a teenager participates in transformation socially oriented activities, his own projects, mentoring, engaging with society. This is the "Master" position. Reaching the Master level, a teenager manages his own projects approved by the leader. The authorship of the idea, the planning of actions, the selection of tools, the search for resources, the distribution of assignments, the monitoring of implementation, the implementation and dissemination of socially useful practices belong to the “Master”. The motto of their personal agency is the phrase: "I know what to do, and I will teach you!"

Stage 5 – the position “Creator” – the highest stage of development of personal agency, it is often unattainable in full. Only those adolescents who have made their career choice or have high abilities in some activity or are gifted get to this level of development of personal agency. The “Creator’s” projects do not have to be accompanied by a leader (teacher or experienced designer). "Creator" can fully accompany the projects of "Masters", that is, thus being a mentor in the model "teenager – to teenagers." But mentoring is not the main occupation of the “Creator”. He has his own concernment, which is based on his idea of social transformation. "Creator" has the abilities of a strategist and tactic in one person, he is a leader, his personal agency is manifested in the credo: "I will make this world beautiful!" “Creator” is not a narcissistic type; he soberly assesses the situation, sees the risks and imperfection of his performance. The teenager at this stage of technology implementation is characterized by a high willingness to transform, he is firmly on the path of education and self-education, has a strong and stable interest, and has the charisma of a leader.

Since a number of authors consider the focus on personal self-development as one of the important signs of personal agency, we used the “Diagnostics of the realization of self-development needs” methodology (Fetiskin et al., 2002) to identify the degree of the acceptance of certain indicators of self-development need in adolescents in the studied groups. The authors identified 15 indicators of this kind, each evaluated on a five-point scale, corresponding to the gradation from full acceptance to its insignificance.

To assess the degree of reliability of differences between the studied parameters in the control and experimental groups, we used such a method of mathematical statistics as χ^2 – Pearson's criterion.

In order to create psychological and pedagogical conditions for the development of personal agency, adolescents of the experimental group were included in a special program of socio-psychological trainings by E. Druzhina, meeting the requirements of the adolescent's need for self-development. The content of the trainings included the following topics: “Secrets of willpower: how to overcome laziness?”, “Self-confidence is real”, “How to manage your emotions and cope with stress”, “I am a leader”, etc.

3. Results

The results of the questionnaire “Assessment of the stages of formation of personal agency” gave us the opportunity to compare the frequency of occurrence of certain stages of personal agency in adolescents in the process of realization of socially oriented activities (see Table 1). Having determined the correspondence between the stage and the particular survey participant,

we calculated the frequency of occurrence of each stage in the EG and CG. Basing on this they were assigned a rank from the first to the fifth, where the first rank corresponded to the stage most often observed among the respondents.

In the control group, more than half of the participants (56 %) placed themselves into the third stage, the “Apprentice”, thereby admitting their lack of independence in terms of evaluating the results of socially oriented activities. The second place, 26 % of adolescents, is taken by the “Student” stage, in which one's own activity is qualitatively manifested only if there is a standard that needs to be imitated. The third rank is at the “Master” stage – 10 % of adolescents believe that they are completely independent in planning activities and setting its goals. The fourth rank was received by the “Observer” stage, in which difficulties with independent activity are observed even with external support (6 %). The last, fifth, rank was given to the “Creator” stage, the most difficult stage, which makes it possible not only to control one’s own activity, but also to influence others (2 % of adolescents).

In the experimental group as well, the first place belongs to the stage "Apprentice", it is typical for 48 % of adolescents. The second place, 28 % of respondents, occupies the "Master" stage. The third rank belongs to the “Student” stage (16 % of respondents). The fourth rank – to the “creator” stage (6 % of adolescents), and the fifth rank is given to the stage of “Observer”; it is inherent in only two percent of schoolchildren.

Table 1. The occurrence rate of adolescents’ personal agency development stages

	Control group		Experimental group		χ^2	df
	rank	percentage	rank	percentage		
Observer	4	6%	5	2%	3.83	4
Student	2	26%	3	16%	14.43*	4
Apprentice	1	56%	1	48%	6.78	4
Master	3	10%	2	28%	15.76*	4
Creator	5	2%	4	6%	3.83	4

Note: * Statistically significant differences ($p < 0.05$)

Comparing the results of the control and the experimental groups, you can see that most of the adolescents who has taken part in the study are at the “Apprentice” stage, that is, they need some external control from a person who is knowledgeable in the activity being implemented and is able to correct and evaluate their work. However, the ranks of the rest stages in the studied groups do not coincide. In the experimental group, the presence of higher stages of personal agency, such as “Master” and “Creator”, is more prominent. The representation in the Master stage in the studied groups is noticeably different. In the control group, 10 % of schoolchildren belong to it, and in the experimental group – the index is 28 %. In addition, the initial stages of personal agency, such as the “Observer” and the “Student”, are much less common in the experimental group. According to the Pearson criterion χ^2, the number of degrees of freedom being 4, the distribution of the results between the “Student” and “Master” stages in the EG and the CG is statistically significant at a 5 % confidence level.

The obtained results confirm the important role of the additional education in the productive formation of a socially-individual level of development of adolescents’ personal agency.

Our study also revealed certain differences in the control and the experimental groups in the needs of adolescents in self-development as one of the leading indicators of personal agency (Table 2).

Table 2. The level of acceptance of the need for self-development indicators in the control and experimental groups

Need for self-development indicators	The degree of the acceptance of the indicators										χ^2	df
	high		Above the average		average		Below the average		low			
	EG	CG	EG	CG	EG	CG	EG	CG	EG	CG		
I aspire to know myself	53%	37%	22%	23%	19%	29%	6%	11%	0%	0%	6.42	4
I make some time for self-development no matter how busy I	6%	5%	21%	14%	38 %	33%	24%	28 %	11%	19%	4.28	4
Occurring difficulties stimulate my activity	35%	30 %	18%	21%	18%	14%	17%	21%	12%	14%	1.69	4
I look for some feedback as it helps me to know and recon myself up	53%	48 %	12%	20 %	29%	13%	6%	19%	0%	0%	15.1**	4
I analyze my activity making special time for it	41%	30 %	25%	20 %	12%	31%	16%	12%	6%	7%	11.3*	4
I investigate my feelings and experience	41%	32%	41%	40 %	18%	28 %	0%	0%	0%	0%	3.29	4
I read a lot	24%	17%	22%	21%	24%	27%	18%	24%	12%	11%	2.29	4
I debate on issues that are of interest for me	46%	33%	24%	36%	19%	19%	5%	12%	6%	10%	7.96	4
I believe in my abilities	63%	45%	24%	29%	6%	22%	6%	6%	0%	0%	12.57**	4
I try to be a more outer-directed person	29%	23%	41%	36%	12%	28 %	6%	6%	12%	7%	8.73	4
I am aware of the influence that other people have on	46%	38 %	18%	19%	24%	32%	6%	6%	6%	5%	2.02	4
I am in control of my future career development and get successful outcome	35%	26%	22%	12%	32%	35%	6%	17%	5%	10%	11.33*	4
I take pleasure in learning new skills	76%	52%	6%	13%	12%	17%	6%	18%	0%	0%	13.94**	4
I am not afraid of the growth of responsibility	35%	20 %	30 %	26%	29%	36%	6%	18%	0%	0%	11.13*	4
Professional advancement	70%	61%	24%	32%	6%	7%	0%	0%	0%	0%	1.83	4

Note: * Statistically significant differences ($p < 0.05$);
** Statistically significant differences ($p < 0.01$)

To define the degree of reliability of the observed differences, we compared the results of the experimental and control groups for each indicator using the Pearson χ^2 criterion, the number of degrees of freedom being 4. It turned out that for several parameters, statistically significant differences were found at a 5 % significance level. This attitude to the reflection of their activities ($\chi^2 = 11.3$, $p < 0.05$), the management of their future professional development ($\chi^2 = 11.33$, $p < 0.05$) and the attitude to increasing responsibility ($\chi^2 = 11.13$, $p < 0.05$).

In addition, statistically significant differences at the 1% level were present between the experimental and control groups in such indicators as the search for feedback for self-esteem and self-knowledge ($\chi^2 = 15.1$, $p < 0.01$), faith in one's own abilities ($\chi^2 = 12, 57$, $p < 0.01$), getting pleasure from learning new things ($\chi^2 = 13.94$, $p < 0.01$).

Note that these indicators can indeed be considered very important characteristics of an individual's personal agency. The combination of a tendency to reflect on one's own activity and faith in one's own abilities allows one to analyze the achieved results without disappointment caused by some errors. On the contrary, it makes it possible to take them into account and avoid them in the course of further activity. Being engaged in the system of additional education make the teenager to realize that he can really make independent choices, relying on his interests and inclinations, while at school he is obliged to study all the subjects which are on the program

regardless of how much he is interested in them. The increased willingness to accept responsibility among such adolescents characterizes their higher personality maturity.

At the ascertaining stage of the experiment as well as in the course of the experiment in general, noticeable discrepancies were found in the significance of the need for self-development of adolescents depending on the degree of their inclusion in the socially enriched environment of additional education. This was manifested in the fact that the average group result in the experimental group, got through the implementation of this technique, was 59.1 points, which, according to its authors, indicates that the individual actively fulfills his need for self-development. The overall result of the control group was 53.8 points, which can be interpreted as the presence of this need, but with an insufficiently developed system of self-development.

The fact that there are no significant differences in the greatest part of the considered indicators can be explained by a number of factors of socialization of adolescents that are similar in the control and experimental groups.

4. Discussion

The discourse of scientists on the development of personal agency of adolescents is associated with the use of pedagogical conditions that are created in various educational and social environments to ensure the success of this process. Our experimental work was aimed at testing one of these conditions.

To develop personal agency in the educational and social environment, researchers suggest that educators create spaces of social positioning allowing adolescents to achieve personal achievements such as meaning-making and self-determination. So, L.S. Vygotsky made a point that the child is realized through personal experience, which, in turn, is mediated by the environment. Hence, he sees the main task of teachers, first of all, in the correct regulation and organization of the social environment (Vygotsky, 1996).

To help teenager initiate a subjective action, it is advisable to design specific types of psychological and pedagogical situations for adolescents. V.I. Slobodchikov, E.I. Isaev distinguish three typical situations for the development of personal agency of adolescents: educational-experimental, project-research and that of a pre-vocational choice (Isaev, Slobodchikov, 2013).

The situations proposed by scientists for the development of personal agency of adolescents fit perfectly into the educational space of the school. However, the school environment, with significant potential for the development of personal agency, has limitations associated with the existence of strict regulations for organizing the life of teachers and students, having their focus on achieving the result set by the educational standard, ignoring personal goals, etc.

The social environment, such as the “social oasis” (E. Fromm), and the socially enriched environment (Chernyshev et al., 2007) have different characteristics. It marks a much higher level of intensity and content of both communication and joint activities. The activity of adolescents in such an environment is emotional, aimed at creation and cooperation. At the same time, they are included in the “fan of activities” that mediate the communicative, intellectual, behavioral components of the life of adolescents.

According to T.A. Antopolskaya, the socially enriched environment of institutions of additional education for children (Antopolskaya, 2009) preserves and cultivates the natural uniqueness of each child, ensures the accelerated the development of new social experience in interaction with adults of importance, implements various options for group and individual training, offers a free choice of content and forms of activity, has a huge educational potential, focused on moral, spiritual, cultural and social values.

In the environment of additional education, a teenager feels the freedom in both the choice of an educational program and in having the opportunity to test his point of view, judgements and role in various groups. It is in the environment of additional education that a teenager appreciates being a transformer, creator, a person who is actively responsible for other subjects of the social environment.

Another condition for the development of personal agency of adolescents is their subjective interaction with other social actors (peers and adults) and social objects (library, museum, etc.) in a socially enriched environment. It is important not only for the process of socialization of a teenager, but also creates new opportunities for designing and developing the system of his social relations with the world as a whole, gaining new personal activity experience.

To develop personal agency of adolescents, researchers suggest using active methods and technologies: social learning, technology for updating group potentials, team building trainings and those of effective communication. All these together also provide opportunities for the development of personal agency of adolescents.

In course of the experimental work our research team tested a technology for the development of personal agency of adolescents in a socially enriched environment of additional education based on their inclusion in socially oriented activities. From our point of view, it contributes to the effective achievement of certain levels of personal agency at each of its stages and has advantages in its variability, unique nature and polysubjectivity.

Limitations

The limitations connected with the number of examinees both in the control and in the experimented groups do not allow to extend the research data to the general community of pupils attending institutions of additional education thus applying only to teenage school children from Kursk.

5. Conclusion

1. A review of some studies of personal agency made it possible to state that such a phenomenon as the personal agency of adolescents has a multi-valued interpretation, its formation goes through several stages and can be studied at several levels.

2. The results of an experimental study of the socially-individual level of personal agency of adolescents demonstrate that the inclusion of adolescents in the system of additional education contributes to the development of their personal qualities that encourage them to strive for the new, actively plan their future and take responsibility for their choice.

3. There are pedagogical conditions in which the development of personal agency of adolescents proceeds more successfully: the creation of a socially enriched environment; subjective interaction of adolescents with other social actors (peers and adults) and social objects; the use of active methods and technologies in the education of adolescents.

4. The challenge of further research is to determine the characteristics of the personal agency of those adolescents whose main activity is communication on the network, creating a model of psychological and pedagogical support for the development of personal agency of a teenager.

6. Acknowledgments

The research is funded by the grant provided by the Russian Foundation for Basic Research (project No. 20-013-00073-A“The development of personal agency of adolescents of generation Z in a socially enriched environment of continuing education”).

References

Abulkhanova, 2016 – *Abulkhanova, K.A.* (2016). Mirovozzrencheskii smysl i znachenie kategorii sub"ekta [Worldview meaning and significance of the category of subject]. *Vestnik Krasnoyarskogo gosudarstvennogo pedagogicheskogo universiteta im. V.P. Astaf'eva*. № 4 (38). Pp. 162-168. [in Russian]

Antopolskaya, 2018 – *Antopolskaya, T.A.* (2018). Organizatsiya dopolnitel'nogo obrazovaniya detei v sovremennykh sotsiokul'turnykh usloviyakh: napravleniya razvitiya [Organization of additional education for children in modern sociocultural conditions: development directions]. *Pedagogicheskii poisk*. 11 (263): 4-8. [in Russian]

Antsyferova, 2000 – *Antsyferova, L.I.* (2000). Psikhologicheskoe soderzhanie fenomena sub"ekta i granitsy sub"ektno-deyatel'nostnogo podkhoda [The psychological content of the phenomenon of the subject and the boundaries of the subject-activity approach]. Problema sub"ekta v psikhologicheskoi nauke. Otv. red. A.V. Brushlinskii [i dr.]. M. Akademicheskii proekt, Pp. 27-42. [in Russian]

Boltanski, K'yapello, 2011 – *Boltanski, L., K'yapello, E* (2011). Novyj duh kapitalizma [The new spirit of capitalism]. *Logos*. 1 (80): 76-103. [in Russian]

Bondarevskaya, 2020 – *Bondarevskaya, E.V.* (2020). Vospitanie rebenka kak cheloveka kul'tury [Raising a child as a person of culture]. [Electronic resource]. URL: https://mylektsii.ru/11-81875.html [in Russian]

Chernyshev et al., 2007 – *Chernyshev, A.S., Lobkov, Yu.L., Sarychev, S.V., Sucureatin, V.I.* (2007). Sotsial'no odarennye deti: put' k liderstvu (eksperimental'nyi podkhod) [Socially gifted children: the path to leadership (experimental approach)]. Voronezh: Quarta, 210 p. [in Russian]

Dergacheva, Leont'ev, 2011 – *Dergacheva, O.E., Leont'ev, D.A.* (2011). Lichnostnaya avtonomiya kak sostavlyayushchaya lichnostnogo potentsiala [Personal autonomy as a component of personal potential]. Lichnostnyi potentsial: struktura i diagnostika. M.: Smysl. Pp. 210-240. [in Russian]

Fetiskin et al., 2002 – *Fetiskin, N.P., Kozlov, V.V., Manuylov, G.M.* (2002). Sotsial'no-psikhologicheskaya diagnostika razvitiya lichnosti i malykh grupp [Socio-psychological diagnosis of the development of personality and small groups]. M. Izd-vo Instituta Psikhoterapii. 362 p. [in Russian]

Fine, 2019 – *Fine, C.* (2019). Mind Change: How Digital Technologies Are Leaving Their Mark On Our Brains. [Electronic resource]. URL: https://www.ft.com/content/d8216222-2170-11e4-a958-00144feabdc0 (date of access: 06.20.19.)

Gushchina, 2013 – *Gushchina, T.N.* (2013). Pedagogicheskie osnovaniya razvitiya sub"ektnosti starsheklassnikov v sisteme dopolnitel'nogo obrazovaniya [Pedagogical bases for the development of personal agency of high school students in the system of additional education]: avtoref. dis. ... d-ra ped. nauk. M., 44 p. [in Russian]

Isaev, Slobodchikov, 2013 – *Isaev, E.I., Slobodchikov, V.I.* (2013). Psikhologiya obrazovaniya cheloveka: Stanovlenie sub"ektnosti v obrazovatel'nykh protsessakh [Psychology of human education: The formation of personal agency in educational processes]: uchebnoe posobie. M.: Izd-vo PSTGU, 432 p. [in Russian]

Mudrik, 2016 – *Mudrik, A.V.* (2016). Sotsiokul'turnye vyzovy sovremennoi rossiiskoi shkole na makrourovne [Sociocultural challenges of the modern Russian school at the macro level]. *Sibirskii pedagogicheskii zhurnal.* 1: 117-124. [in Russian]

Panova, 2018 – *Panova, M.* (2018). Stanovlenie sub"ektnosti u uchashchegosya i u pedagoga: ekopsikhologicheskaya model' [The formation of personal agency in the student and the teacher: ecopsychological model]. Pod red. V.I. Panova. M.: PI RAO; SPb.: Nestor-Istoriya, 304 p. [in Russian]

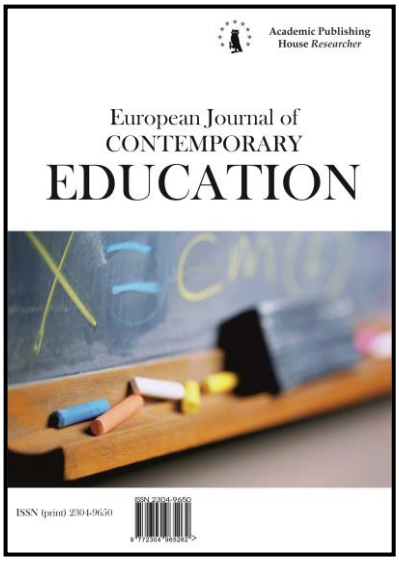
Selivanova, 2017 – *Selivanova, O.G.* (2017). Metodologiya i organizatsiya obrazovatel'noi deyatel'nosti shkol'nika [Methodology and organization of educational activity of a student]. Kirov, VyatGU, 229 p. [in Russian]

Soldatova et al., 2017 – *Soldatova, G.U., Rasskazova, E.I., Nestic, T.A.* (2017). Tsifrovoe pokolenie Rossii: kompetentnost' i bezopasnost' [The digital generation of Russia: competence and security]. M.: Sense, 375 p. [in Russian]

Vygotsky, 1996 – *Vygotsky, L.S.* (1996). Psikhologiya razvitiya kak fenomen kul'tury [Developmental psychology as a cultural phenomenon]. M.: Nauka. 510 p. [in Russian]

Zubova, 2011 – *Zubova, D.A.* (2011). Fenomen sub"ektnosti v prostranstve sovremennoi filosofskoi refleksii [The phenomenon of personal agency in the space of modern philosophical reflection]: avtoref. dis. ... kand. fil. nauk. Rostov-na-Donu, 20 p. [in Russian]

Published in the Slovak Republic
European Journal of Contemporary Education
E-ISSN 2305-6746
2020, 9(3): 529-545
DOI: 10.13187/ejced.2020.3.529
www.ejournal1.com



Peculiarities of Engineering Thinking Formation Using 3D Technology

Natalia A. Bushmeleva [a, *], Natalya I. Isupova [a], Ekaterina A. Mamaeva [a], Elena V. Kharunzheva [a]

[a] Vyatka State University, Kirov, Russian Federation

Abstract

The problem of the research is due to the need to create a special engineering style of thinking within the digital educational space, which implies readiness for research, creativity, responsibility, and supported by modern high-tech tools in order to provide resources for solving the problems of Industry 4.0.

The purpose of the study is to theoretically substantiate and experimentally verify the effectiveness of using 3D technologies for the formation of engineering thinking as an important competence of a high-demand specialist in the digital society.

The research methodology is a theoretical and methodological analysis and generalization of fundamental scientific works in the field of digitalization of education, training of engineering and technical personnel, three-dimensional modeling, application of software for the development of thinking. The pedagogical experiment uses the example of assessing the formation of personality qualities and skills that form the basis of engineering thinking. The sign criterion G is used as a method of statistical processing and verification of the reliability of the obtained results.

Research results. The authors clarify the concept "engineering thinking" in the context of training specialists for Industry 4.0 and substantiate the potential of 3D technologies for the formation of engineering thinking. They formulate the principles and supporting directions of the mentor of students' research activities in 3D modeling. The authors present a system of work on an interdisciplinary project underlining skills significant for the formation of engineering thinking.

The authors come to the conclusion that the use of 3D-technologies in training creates additional conditions for the development of qualities and skills that ensure the integrity of engineering thinking formation as a universal competence of a high-demand professional of the future.

Keywords: engineer of the future, 3D-model, principles of support, project, didactic potential, professional self-determination.

* Corresponding author
E-mail addresses: na_bushmeleva@vyatsu.ru (N.A. Bushmeleva), natalyisupova@mail.ru (N.I. Isupova), mamaevakathy@gmail.com (E.A. Mamaeva), kharunzhevaea@mail.ru (E.V. Kharunzheva)

1. Introduction

1.1. Relevance of the problem

The research is urgent due to the following factors:

1. An important condition for ensuring the country's technological and economic independence in the context of digitalization and integration of production processes is the training of high-quality engineering personnel (Varshavskaya, Kotyrlo, 2019).

2. Training a creative, responsible specialist with research skills and experience in intellectual activity supported by modern high-tech tools is an urgent area of modernization of science and education (Isaev, Plotnikov, 2019). The purpose of digitalization of education in the context of the development of Industry 4.0 is to effectively and flexibly apply the latest technologies to the transition to a person-oriented, continuous and non-linear educational process (Ilomäki, Lakkala, 2018). The digital era requires not only new skills from graduates of schools and universities, but also a different approach to organizing the education process in terms of training engineering personnel. In these conditions, Russian and foreign researchers (Tocháček et al., 2016; Terzidou et al., 2018; Szymanski, 2018; Soboleva, 2019; Karakozov, Ryzhova, 2019) point out that the didactic process in the era of automation and globalization should solve problems of socio-economic development of the country in the context of the formation of Industry 4.0.

3. According to R.A. Perelet (Perelet, 2019), foundation of the digital economy is a synthesis of previously existing material production and digital technologies, supporting the widespread use of artificial intelligence models and the development of the Internet of things. According to R. E. Paterson (Paterson, 2017), "smart products" will be the norm in a world where intelligent computerized devices (robots), the systems consisting of them, get opportunities for interaction in the preparation and deployment of automated production processes.

The new industrial, or technological (digital) revolution, has special demands to the highly qualified specialists of the future. Other scientists, for example V. Concepción (Concepción et al., 2018), reasonably conclude that in the educational space a priority is the task of preparing an independent personality through the formation of high-order thinking, including engineering. Engineering thinking in the new conditions of Industry 4.0 is perceived and interpreted as "a specific form of active reflection of the morphological and functional relationships of the subject structures of practice, aimed to meet the technical needs for knowledge, methods, techniques in order to create technical means and organize technologies" (Usoltsev, Shamalo, 2015).

The digital transformation of the manufacturing sector is already underway (Ranger, Mantzavinou, 2018). However, while implementing technological innovations, there can be problems due to insufficient training in terms of the formation of engineering thinking, which is based on the ability to analyze the composition, structure and principle of operation of technical objects in new conditions (Rozhik, 2017). There is a practical need to change the principles of organizing a digital educational environment for the development of engineering thinking among professionals of the future. The indicated need implies the integration of new technical means into real projects, their promotion in science and industry (Soboleva i dr., 2020a).

In connection with these factors, studying the potential of 3D modeling tools and technologies in terms of training engineers of the future is relevant (Suvorova, Mikhlyakova, 2020). Support for engineering education is one of the strategic priorities of the development of Russia. Therefore, engineering classes, physics and robotics laboratories, 3D modeling and prototyping workshops are created and developed. A digital school teacher gets additional opportunities for developing engineering thinking skills by combining educational and extracurricular work, supporting students in the construction of 3D devices not only for an educational project, but also for professional self-determination, participation in competitions.

Thus, there is an objective need to study peculiarities of the formation within the digital educational space of a special engineering style of thinking, which implies a willingness to research, creativity, responsibility, and supported by modern high-tech tools in order to provide resources for solving the problems of Industry 4.0.

1.2. Aims and objectives of the study

The aim of the study is due to the need to attract students to project activities in 3D-modeling for the formation of engineering thinking as a universal skill of a high-demand professional of the future.

Research Objectives:

– to clarify the concept "engineering thinking" in the context of training specialists for Industry 4.0;

– to substantiate the potential of 3D-technologies for the formation of engineering thinking as a necessary skill of high-demand professionals of the future;

– to formulate principles, directions of support of the mentor of students' research activities in 3D-modeling.

– to introduce a system of work on an interdisciplinary project, highlighting significant skills for the formation of engineering thinking.

– to experimentally confirm that the inclusion of students in practice-oriented activities for the design of three-dimensional models, the development of "smart" solutions for Industry 4.0 can improve the quality of training of a future specialist in terms of the formation of skills that form the basis of engineering thinking.

2. Relevance

2.1. Literature review

2.1.1. Analysis of Russian scientific and pedagogical literature

The formation of Industry 4.0 defines the introduction of new business models, according to which the "factories of the future" will work – enterprises capable of providing a fundamentally new level of productivity and competitiveness. Such a powerful push will be possible thanks to digital technologies that can process huge amounts of data and comprehensively manage production processes, from design and manufacturing to logistics and technical support for the product (Karakozov, Ryzhova, 2019). Requirements for technical professions related to industrial production are changing now, they are rethinking the tasks of specialists who have to work at smart plants or conduct scientific research (Varshavskaya, Kotyrlo, 2019). Therefore, the Russian school has a crucial task – to give future engineers, technologists, designers sufficiently deep knowledge and practical skills in the field of latest technologies so that they enter the digital world fully equipped (Isaev, Plotnikov, 2019).

Russian scientists E.V. Soboleva, N.I. Isupova in their studies (Soboleva i dr., 2020) treat the "engineer of the future" as a specialist who has a high culture, well aware of modern engineering and technology, economics and organization of production, knows how to use engineering methods for solving problems of Industry 4.0.

Studies of A.P. Usoltsev, T.N. Shamalo (Usoltsev, Shamalo, 2015) demonstrate that innovation activity has a complex structure: it is an integral result of many branched processes and should be considered in the unity of all their aspects. The core of this activity is specific engineering thinking, supporting all stages of the development and implementation of discoveries, ensuring their quality and productive practical application (Kudryavtsev, Yakimanskaya, 1964). Such thinking is formed over a rather long period in a favorable environment stimulating thought processes. It allows to assert that preparing young people for innovative activity and developing their corresponding thinking requires the use of innovative pedagogical technologies, techniques and tools (Suvorova, Mikhlyakova, 2020).

Engineering thinking is generally understood as thinking that supports the qualitative result of technical activity (Rozhik, 2017); a specific form of active reflection of the morphological and functional relationships of the subject structures of practice, aimed to meet the technical needs for knowledge, methods, techniques, in order to create technical means and organize technologies (Soboleva i dr., 2020a); the ability to make decisions that go beyond existing algorithms and technologies (Suvorova, Mikhlyakova, 2020); the skill to question the effectiveness of traditional methods, accept contradictions and rethink them creatively, show creativity and a culture of research (Isaev, Plotnikov, 2019).

In various approaches to studying the formation of a student's engineering thinking, which consider its development using special conditions (Isaev, Plotnikov, 2019) or modern teaching technologies (Soboleva i dr., 2020a), there is no strategy for organizing special activities (Ignatova, Filimontseva, 2019). The main task of modern education of the engineer of the future for Russia is not just the transfer of experience and knowledge, but the preparation of a competent specialist

capable of self-development and self-realization, able to solve non-standard tasks, predict the outcome of future activities and focus on universal values (Martyakova, Gorchakova, 2019).

Summarizing all the approaches, we conclude that the concept of "engineering thinking" is related to the thought process leading to the solution of interdisciplinary engineering problems, creative ideas, innovations, and design projects.

According to I. Damyanov, N. Tsankov (Damyanov, Tsankov, 2018), the modeling activity allows students to get important skills to strengthen theoretical knowledge and awareness of their future professional career. However, mastering these tools requires significant thought efforts, imagination, engineering thinking, and the ability to self-creation. The mentor is required to organize targeted pedagogical support, involving the planning of innovative educational activities.

I.D. Stolbova, E.P. Aleksandrova, L.V. Kochurova, K.G. Nosov examine the profile aspects of graphic education (Stolbova i dr., 2019). The authors believe that in order to bridge the gap between the level of graduates' training and the real requirements of society and industry, it is necessary to introduce innovative educational technologies aimed to build the ability to work in a team, competencies in the field of digital technologies, willingness to carry out design based on spatial modeling. An important result of the work for the study is the justification of the need for the practice of implementing projects in 3D format for the development of engineering thinking. According to M.L. Soboleva, M.A. Fedotenko (Soboleva, Fedotenko, 2019), the main innovative technologies in education are the following: mobile platforms and services; training programs based on artificial intelligence and big data analysis; digital resources to influence feedback intensity; innovative forms of activating cognitive activity of students.

M. Chugunov, I.N. Polunina represent an interdisciplinary approach that integrates 3D modeling methods and tools in the educational process (Chugunov, Polunina, 2018). The problem is solved in two interconnected environments: full-scale and virtual. Work in 3D spaces is necessary for designing cyberphysical devices, implementing innovations in science and technology. They describe a scientific design approach based on the use of an integrated modeling environment. The design process is implemented as the creation of different types of models: full-scale and virtual. The authors substantiate that such an approach to design is very effective for strengthening intersubject communications, forming the foundations of creative research.

O.A. Mudrakova, S.A. Latushkina apply the didactic capabilities of 3D modeling in practice in order to develop spatial thinking (Mudrakova, Latushkina, 2020). Scientists analyze the features of classes, review the experience of using 3D-modeling in training.

An analysis of the requirements of Russian employers allows to reasonably conclude that a specialist with experience in three-dimensional modeling, capable of making discoveries and putting them into practice, can find a job as a designer, artist, visualizer, designer in the game and film industry (Varshavskaya, Kotyrlo, 2019). For example, when designing structures of mechanisms and buildings, a high-demand professional needs experience in the development of three-dimensional models according to drawings and technical specifications in computer modeling environments. When modeling the game world, a highly qualified specialist will need the speed of creating the model, applying the correct topology to make the 3D model and the original concept similar.

Thus, an analysis of Russian literature suggests that 3D modeling technologies really contribute to the formation of an educational space that supports the development of engineering thinking in the course of creative work on the construction of three-dimensional objects. As a result, domestic researchers recognize the need to improve the training model, taking into account the capabilities of 3D technologies to meet the challenges of the future, ensure competitiveness, support professional self-realization of a student, and develop demanded engineering thinking.

2.1.2. Analysis of foreign researches

D. Tocháček, J. Lapeš, V. Fuglík (Tocháček et al., 2016) note that the need for innovation in science and technology determines the need for engineering personnel capable of integrating knowledge from various industries. The educational environment has all the possibilities in order to fully respond to the challenges of the future. One option is training using 3D technology (Terzidou et al., 2018). Foreign researchers M. Rodríguez-Martín, P. Rodríguez-Gonzálvez, A. Sánchez-Patrocinio, J.R. Sánchez (Rodríguez-Martín et al., 2019) point out that modeling activities are a useful tool for creating universal competencies for the professions of the future, including engineering thinking.

A.I. Benzer, B. Yildiz prove that computer 3D modeling, as one of the innovative digital technologies, is able to provide great opportunities for the formation of demanded skills of students (Benzer, Yildiz, 2019). The authors study the influence of technology on the imagination, preparation for professional self-realization.

T.-Ch. Huang, Ch.-Y. Lin consider various aspects from 3D modeling to 3D printing (Huang, Lin, 2017). They demonstrate that work in a three-dimensional environment develops the skills of observation, design and information processing. However, individual differences and psycho-physiological characteristics can affect learning outcomes, understanding the principles of three-dimensional modeling. In the framework of 3D-modeling, students must learn to look at things from different angles, be able to build abstract cognitive spaces. T.-Ch. Huang, M.-Y. Chen, Ch.-Y. Lin note that as 3D technologies evolve, 3D printers are also being introduced into education as a means of cognition and learning (Huang et al., 2019). In addition, students get the opportunity to observe and physically respond to the model, improving the quality of design and understanding. A. Sánchez, C. Gonzalez-Gaya, P. Zulueta, Z. Sampaio discuss the use of prototypes to solve the problems of three-dimensional modeling and 3D printing as support for the development of mathematical understanding, creativity and technological literacy (Sánchez et al., 2019). T. Molano points out that one of the manifestations of the prevailing technological megatrends is 3D printing, along with robotics and new types of energy (Molano, 2020). A. Szymanski identifies the possibilities of 3D printing for the formation of an innovative type of thinking (3D thinking), as well as the advantages of using 3D printing resources in the educational process (Szymanski, 2018). Moreover, according to L. Wei, K. Lu, X. Zhang, another factor determining the relevance of the study of 3D technology and the practice of 3D modeling is the increasing competition in the labor market and in the global economic space (Wei et al., 2019).

K. Hutchison, L. Paatsch, A. Cloonan justify that the technology of creating three-dimensional images blur the boundaries of the real and virtual world. However, their practical application is largely limited to industrial prototyping, inclusion of computer-aided design/automated production for the manufacture of virtual models (Hutchison et al., 2020). The authors emphasize that mastering the methods of three-dimensional modeling becomes an important universal competency, and innovations supported by the use of 3D technologies can lead to breakthroughs in science and industry. In particular, modern 3D image transfer technologies support the development of the film and video industries. For example, glasses with multi-colored or polarizing filters create the illusion of volume. Soon real three-dimensional displays will be widespread both in science (for visualizing various kinds of 3D objects) and in the entertainment industry (Lin et al., 2020). The design of 3D displays embodies the principle of generating 3D images using a rapidly rotating flat screen (due to the inertia of human vision, a two-dimensional picture unfolds in three-dimensional); principle of creating a display according to the 2D principle (volume is built from discrete elements of variable brightness).

As B. Tepavčević notes, technologies that support 3D modeling must be implemented in all spheres of life (Tepavčević, 2017). 3D graphics technologies are a potential future development of the economy. For example, 3D printing can minimize the need for construction and technical documentation and lead directly to the printing of full-size experimental models preceding the construction of building structures (Novak, Wisdom, 2018). In addition, 3D designers will be able to use special methods and technologies in their work: visualization, animation, 3D design and rendering, which will turn ideas into digital objects. When converting 3D images into physical objects, specialists will turn directly to 3D modeling and design technologies.

Thus, if there is a certain disagreement in revealing the phenomenon of “engineering thinking”, most researchers recognize the didactic potential of 3D technologies for the development of engineering thinking. The implementation of this involves the creation of conditions for the identification, motivation, support and encouragement of students who are interested in 3D-technologies (3D-printing, 3D-modeling, 3D-scanning, three-dimensional artistic and technical creativity); improving the quality of education, activity among students; deepening understanding of the physical foundations of the functioning of constructed mechanisms; introduction of new educational technologies in the educational space; development of cooperation between the education system and potential employers; support for professional self-determination of personality; distribution and popularization of information on new digital technologies. Accordingly, a wide range of problems of a didactic and software-technical nature is revealed:

the need to master a new three-dimensional modeling environment, the difficulties of substantive and task filling, the design of an educational environment in accordance with the requirements of the labor market, challenges of the future, etc.

All of the above circumstances determine the significance of the study.

3. Materials and methods

3.1. Theoretical and empirical methods

The authors have analyzed foreign and Russian studies in order to clarify the concepts "engineer of the future", "engineering thinking" in the conditions of the need to change the training of technical specialists for the formation of Industry 4.0. In particular, they generalized and systematized methodological foundations of applying the competency-based approach to the design of education (Khutorskoy, 2017), the transition of the education system to a personality-oriented learning model (Suvorova, Mikhlyakova, 2020).

The study of the didactic potential of 3D technology tools was carried out using the analysis of specific developments of subject teachers, interdisciplinary projects, generalization of innovative experience in teaching three-dimensional modeling. When organizing the study, the authors have taken into account provisions of the system-activity approach, considering the structure of activity and explaining the process of active assimilation of knowledge by the subject, the formation of methods of its activity through motivated and purposeful solution of the problem system.

When studying the methodological aspects of using 3D technologies in the educational space for the development of engineering thinking, creativity, pragmatism, manufacturability, etc. The authors used praximetric methods to describe, characterize, analyze the methods, means, forms of organization and control; systematization and generalization of ideas and patterns, principles of didactics in teaching.

In the course of work, there were used 3D technology tools (3D pens, 3D printers), 3D modeling environments (Blender, WINGS 3D, 3DReshaper, SketchUp, AutoDesk 123D, MESHMIXER 3.0), MS Office resources for presenting data, and educational constructor tools LEGO Mindstorms EV3, an Arduino-based controller programming environment.

A special group consists of empirical methods (observation, analysis of the results of innovative activities of students) to obtain relevant information on the formation of personality skills and qualities that form the basis of engineering thinking, and improving the quality of education in general.

To divide the participants into the experimental and control groups, the data of input testing was used to demonstrate in each group of the same skills and personality traits that form the basis of engineering thinking, their equal distribution. The sign criterion G was used as a method of statistical processing and verification of the reliability of the results obtained (Ostapenko, 2010).

3.2. The base of research

Assessment of the formation of engineering thinking, analysis of design developments of students using 3D technology was carried out in the course of a pedagogical experiment. 79 students of the direction 02.03.02 "Fundamental Informatics and Information Technologies", Faculty of Informatics, Mathematics and Physics, Vyatka State University of Kirov, Russia, took part in the experiment. The experimental (40 people) and control (39 people) groups were formed. All students were 21 years old, in the third year of University. The experiment was conducted in the framework of the discipline "Computer Graphics".

To comply with the rules of probabilistic selection, the same teacher conducted training using 3D technology throughout the experiment. The training was conducted in the same classrooms, on the same hardware and software. To carry out control measures, the authors developed test tasks. All questions complied with the requirements of state federal educational standards for the specified area of training.

3.3. Stages of research

The study had three stages.

At the first stage (as part of a stating experiment), various approaches to determining the concepts "engineering thinking", "engineer of the future", Industry 4.0 were studied. The urgent problems of the formation of engineering thinking as an important competence of a high-demand professional in the digital society were revealed. Then we analyzed scientific and methodological work on the didactic potential of 3D technology tools for the development of skills and

personality traits that form the basis of engineering thinking. At the same stage, we developed and carried out a test, containing of 10 tasks, each task was 2 points. With the help of its results, it was possible to collect experimental data on students of the direction 02.03.02 "Fundamental Informatics and Information Technologies". In the sample, the experimental group had 28 % of girls and 72 % of boys.

Then the participants were divided into groups (40 in the experimental, and 39 in the control group) to demonstrate in each group of the same skills and personality traits that form the basis of engineering thinking, their equal distribution.

At the second stage of the experiment, we formulated the principles and directions of support by the mentor for the research activities of students in 3D modeling. The proposed principles were implemented in the system of work on an interdisciplinary project, which included the identification of methodological, organizational, technical components and the specification of skills that are significant for the formation of engineering thinking.

The third stage of the study was the experimental teaching and improvement of the formulated principles for organizing practice-oriented activities for the design of three-dimensional models, the development of "smart" solutions for Industry 4.0.

4. Results and discussion

4.1. Clarifying the basic concepts

In this study, we will use the following interpretation of the term "Industry 4.0": this is a concept that implies the implementation of the fourth industrial revolution associated with the integration of industrial equipment (or the "industrial Internet of things") and the evolution of automation processes in industry with a qualitative transition of production into the form of a "digital enterprise". An important component of the concept is the emergence of processes for the automated collection, analysis, exchange and use of information in electronic digital form beyond the internal environment of the organization and the creation of a common information system for enterprises engaged in the production, sale and after-sales service of goods, sale of services.

The development of Industry 4.0 necessitates innovative technical developments that support smart solutions. By "smart decision" we mean technologies, objects that support users in finding new ways, improving actions, analytics of current activities, and ensure high-quality interaction with the environment.

A detailed analysis of the definitions "engineering thinking", "innovative thinking", "technical thinking" made it possible to determine the authors' position regarding the studied phenomenon. We will consider engineering thinking as a special kind of thinking that is formed and manifested when solving problems of a technical, design, technological nature, supporting a specialist in making a quick, accurate, original solution for a practice-oriented task and focused on satisfying both technical needs and social needs.

In the presented study, we consider engineering thinking as an integration of technical, economic, research, constructive thinking.

The basis of engineering thinking for a high-demand specialist of Industry 4.0 is RAM, spatial imagination, spatial thinking, and the role of a system-forming factor is performed by intellectual competence. Intellectual competence, as a combination of personal qualities and skills, includes elements of logical, methodological, cognitive activity correlated with real objects. It includes knowledge and skills of goal-setting, planning, analysis, reflection, self-esteem.

The engineer of the future in the conditions of the formation of Industry 4.0 should be ready for professional activity, have demanded professional competencies and engineering thinking. The demanded professional competencies, according to the requirements of the labor market and potential employers, include: a high level of general theoretical technical training; understanding and taking into account broad interdisciplinary relationships; mobility; criticality and rationality; susceptibility to new ideas; ability to see the elements of the system both separately and in unity; ability to independently make responsible decisions and constructive actions in ambiguous situations, predicting and adequately assessing their consequences.

Forming engineering thinking using 3D technology, special attention should be paid to activities, when the future specialist of Industry 4.0 will be able to:

– apply both specialized technical and interdisciplinary knowledge;

– show abilities to see each element of the system separately, relationship between them and the work of the whole system;
– formulate a problem, identify priority tasks and select effective technical means;
– show creativity, independence, non-standard thinking in conditions of restrictions of various nature;
– find rational solutions and compromises in resolving contradictions and conflicts;
–be able to optimally allocate available resources;
–demonstrate, substantiate and justify technically the design solution.

4.2. Design activities of students in the development of engineering solutions

Next, we describe the principles that determine the content of research activities of students in 3D-modeling, contributing to the formation of engineering thinking.

The principle of the need to analyze the requirements of science and industry for engineering and technical personnel of the future. In industries, it becomes possible to choose the materials that are best suited to solve the specific problems of Industry 4.0 (functional prototypes or mass production). A new scientific problem is likely to arise: there will be a need to standardize materials and improve equipment management, especially in industries with high quality requirements, such as the aerospace industry and the manufacture of medical devices. In these conditions, application areas come to the fore rather than technology. When preparing an engineer for the future, we should implement projects which involve the use of 3D technology to profit in specific areas. For example, the improvement of a technical product due to changes in the proportions of the composition, modification of physical and mechanical properties. In this case, we are talking about the implementation of the possibility of constructing the electronic structure of the product according to the 3D model.

The principle of competition, involving the inclusion of students in competitive activities in 3D-modeling, robotics. The implementation of the principle offers participation in seminars, competitions, research laboratories. These organizational forms of training engineers of the future are focused on training specialists who can think outside the box in the face of the uncertainty of the future and work in a team. For example, the international festival “Cyberon”, the 3D-modeling contest among schoolchildren and students “Co3Datel”, the 3D-printing contest “VZDumay”, the “City of 3D-creativity” in 3D-designing and 3D-printing for children and youth.

The principle of taking into account and activation of intersubject communications, involving the implementation of the interdisciplinary didactic potential of three-dimensional modeling activities to form professional skills and the foundations of engineering thinking. For example, in order to restore a historical monument, a specialist of the future must be able to develop a 3D model, design it taking into account the historical context, geographical location, sociocultural significance. Also, an engineer must know biology: to take into account how the human brain perceives depth by merging two images with different perspectives coming from each eye. If innovative materials are used during the reconstruction of the product, then it is necessary to simulate their interaction and environmental impact.

Examples of using 3D scanning and 3D printing are the restoration of the Assumption Cathedral of the Tula Kremlin, the ancient South Gate of the Florentine Baptistery.

The problematic nature of learning. The organization of the corresponding cognitive activity provides a high level of independence in reasoning, in finding solutions in conditions of limitations. For example, you are an employee of a 3D copy center. On October 25, you were sent several orders for the manufacture of products intended for further printing and sale of the finished product for the New Year among the employees of a large holding. The team of your center needs to develop terms of reference for the requirements of the Customer, determine and complete all stages of the project activity in accordance with the available resources, terms.

The principle of training through solving a system of practice-oriented tasks, the key idea is that the concept of “task” can be interpreted quite widely. In this case, the activity of 3D-modeling is presented as a process of resolving contradictions between the proposed course of study, cognitive and practical tasks and the level of formation of engineering thinking and acquired universal skills. The essence of applying the proposed approach to support the development of engineering thinking is that getting new knowledge in solving a technical problem is directed by the teacher through a system of special tasks.

1.1. It is necessary to develop a model of a souvenir mug and print it for sale. Height is no more than 100 mm. Diameter of the upper circle is not less than 100mm. Base diameter is not more than 70 mm. The wall thickness of the cup should be exactly 3 mm. Be sure to apply the image associated with the celebration of the New Year.

1.2. Hedgehog pencil stand with the base in the form of an ellipse. Larger axis of the ellipse is 55 mm. Smaller axis is 45 mm. Clamps for pencils are in the form of hedgehog needles. Be sure to have a hedgehog muzzle on the stand. At least 60 pencils should be placed in the stand. The distance between the needles is 5 mm (pencils should be firmly fixed between the needles of the stand).

1.3. Create a packaging for sweets for a New Year's gift. Parameters are not more than 120 * 120 * 120 mm, but also not less than 100 * 100 * 100 mm. The packaging form should have the New Year theme. Tight contact of one part of the package with another part of it is necessary. Wall thickness should be no more than 3 mm. The application of the name of the holiday is obligatory. It is necessary to think over and calculate the placement on the packaging of the fastener for the gift ribbon, and the packaging can be placed as a pendant.

The principle of continuity between the levels of training of engineering and technical personnel (software, technology, methodological training system). This principle assumes that a chain of cognitive tasks that supports cognition and the formation of engineering thinking takes into account educational results of students at all levels of education. For example, in a preschool, a child masters a 3D pen and with it develops fine motor skills; during the school course, the student receives 3D modeling skills; competitive activity allows to organize the practice of working with 3D printers to protect projects; the learning environment at the university develops universal competencies (collaborations, project activities, programming and work in the face of uncertainty, etc.) and personality traits that form the basis of engineering thinking. For example, in a preschool, a child creates a butterfly using a 3D pen. This is a simple, emotionally vibrant exercise for beginners. The simplicity is that the wings are performed on the plane, can be of various colors and shapes. Hatching is practiced on the wings. Volume can be added to a butterfly body.

At school, a student gets acquainted with the physical structure of butterflies, their habitat, and studies various graphic and text editors. Therefore, the development of the trajectory of knowledge involves the implementation of an interdisciplinary project – to develop a three-dimensional model of a butterfly (for example, Paint 3D), draw up the results and present for discussion. The project is the development of a three-dimensional model of the "Kingdom of the Butterflies", which may be a participant in a competition or Olympiad. In higher education, more technically sophisticated software tools (for example, Maya) act as a tool for 3D modeling. The increasing complexity of theoretical material also supports the development of the trajectory of knowledge (to model a modification of a butterfly model into an elephant). Professional retraining may involve improving an already developed 3D model for new restrictions, new technical capabilities (for example, use them as templates for augmented reality).

The requirements of Industry 4.0 determine that a technician must be able to take on the functions of a designer, marketer, etc. Working with 3D technology allows to get this unique experience. In the course of team work on an interdisciplinary project on 3D modeling, a participant can switch from the role of an idea generator, constructor to the role of a programmer, mechanic, etc. A digital school mentor is required to organize appropriate support and create the conditions for the development of engineering thinking.

The principle of practical application of the obtained prototypes, 3D-models in related promising industries (virtual and augmented reality, neuro-formation).

New training tools, such as the Leica BLK360 compact ground-based 3D laser scanner, allow to get a virtual 3D model of the school for efficient lifecycle management (from design to operation), work in an information modeling environment (BIM-technology), preserve cultural heritage and restoration. The resulting 3D models can be used to organize training sessions in a virtual reality environment as independent objects for subsequent engineering activities.

We will implement these principles using an example of a description of pedagogical support for the development of a prototype of a smart frying pan that does not allow the decomposition of the Teflon layer. The practical problem that the project solves is determined by the following scientific fact: “When the fluoroplastic overheats (even once), thermal decomposition occurs with the release of toxic substances. Cookware with non-stick coatings is considered safe during normal

use. Manufacturers consider the norm only heating with water or oil in a pan. The lack of a device for controlling and preventing overheating of pans and other similar utensils leads to overheating of products, premature failure of them, and the release of toxic substances. "Description of the project content: the basic requirement is not to change the essence of the base product (pans), i.e. externally, functionally. It can cook, it can be washed, including in the dishwasher, it should not be “tied with wires”. If the temperature of the pan is determined, then it will be possible to modernize the stove, making it more convenient (quick heating of the dishes and its contents to the required temperature, maintaining the temperature at a certain level, etc.). The cooking process will become safer. The dishes will become more durable, it will lead to savings in the family budget, more environmentally friendly (due to the absence of toxic emissions), more economical in terms of energy costs for cooking.

Educational result: a model of "smart frying pan" implemented by various means of 3D technology.

Commercial result: a frying pan with a temperature indicator and with an automatic device that does not allow heating above a given temperature.

The interdisciplinary nature of the project involves interaction with the customer; knowledge of the unique material used in high technology industries – fluoroplastic (properties, features, processing); knowledge of the physics of heat transfer (heating, heat sources, types of heat transfer); temperature measurement (means, features, contact and non-contact method); selection skills of primary measuring instruments (sensors); design of coordination circuits with microcontrollers; programming, regulators (integral, PID); engineering skills: drawing, modeling, circuitry; processing of materials (mechanical milling, manufacturing of cases, soldering, etc.); testing (preparation, plan, execution, processing of results);

Stages of project work organized by a teacher in order to form engineering thinking:

I stage. Field of the problem and forecasting development options. Representation of a problem situation in the form of a physical and engineering constraint (response to an existing need). Analysis of the social significance of the project, generation and discussion of methods for its solution and the possibility of achieving an ideal end result for consumers.

II stage. Multivariate analysis of a problem situation: studying the possibility of introducing a device into operation, minimizing resource costs.

III stage. Circuit assembly: sequencing and connecting components.

IV stage. Assembly of the structure. Making the case.

V stage. Application development. Testing the operation of the device in different operating modes.

VI stage. Design decision. Testing the operation of the device in different operating modes.

VII stage. Engineering book for design solutions. Preparation of speeches and presentations based on the results of work on the project. Reflection. Discussion of the project results.

The functions that the engineer of the future within the framework of the project can perform: a mechanic (designing in 3D, 3D printing, creating simple mechanisms), a programmer (initial skills in programming Arduino-based controllers), an electrician (assembling devices, soldering, connecting sensors), a project manager (organization of interaction, correspondence, maintaining a schedule, reporting results).

4.3. Experimental assessment

4.3.1. The ascertaining stage of the experiment

During the preparatory phase, we defined a set of skills and monitored their formation during the development of 3D models. Then we formulated this set tasks for the assessment. Questions for the control event before and after the experiment took into account the provisions formulated by T.V. Kudryavtsev, I.S. Yakimanskaya (Kudryavtsev, Yakimanskaya, 1964). We developed 5 types of tasks, depending on the prevailing mental operation. A feature of the presented system of tasks for control assessment is that the student needs to demonstrate the skills and qualities of the person that form the basis of technical, economic, scientific research, constructive thinking.

1. Tasks when students showed the ability to generalize and concretize technical phenomena (for example, classification problems). An example of a question: to distribute geometric objects into groups according to a specified attribute (a modification of a task may be a situation when a

student defines a classification attribute on his own). Another option: define an extra object in the presented set of objects.

2. Tasks when students showed constructive and technical skills, involving the combination of objects. An example of a question: there are 15 identical parts in a box. An engineer needs to choose three of them. How many ways can he use to do it?

3. Tasks when students showed the ability to recognize problems. An example of a question: you can see various images of a technical engine problem. You need to choose one that informatively reflects the cause of the problem and allows to predict how to solve it.

4. Tasks involving the operation of spatial images. An example of a question: there are projections for two lines *m* and *n*. Lines are located at arbitrary angles relative to the projection planes. You need to choose one that corresponds to their mutual arrangement in space. A modification of the question could be: indicate whether they intersect with each other, and if they do not intersect, then what is their relative position?

5. The task, involving the calculation of economic benefits from the design decision. For example, calculate the reduction in water loss when replacing conventional bathroom taps with automatic touch taps.

Thus, the system of tasks for the control assessment consisted of 10 test questions, it was possible to get 2 points for each one.

4.3.2. Forming stage of the experiment

At the forming stage of the experiment, the teacher analyzed the requirements of Industry 4.0 for engineers of the future. The following areas were identified: mobile devices, augmented reality, interaction with the client, “Internet of things”, analysis of large data arrays, location technologies, human-computer interaction interfaces, 3D printing, “smart” solutions for consumers of social services. In each direction, the mentor developed topics for design. For example, as part of the direction of "location technology," students were asked to develop a 3D model of the school, a natural site. Another variations of such a project are the design of a souvenir, landscape for a computer game.

The control and experimental groups had classes "Computer Modeling". The students of the experimental group were offered possible subjects for projects, they selected those that corresponded to their professional aspirations, cognitive interests, abilities, and educational achievements. They started a software implementation after studying the corresponding theoretical material on 3D modeling, and gaining practice in the design environment. They had one or two months for practical implementation of the concept/idea of the project.

The control group had the traditional mode of studying: basic concepts and stages of working with the model, compilation of information and computer models, their implementation in software environments, analysis and discussion of the results.

When processing and interpreting the materials of the control event, the level of formation of skills that form the basis of engineering thinking was determined according to the following scale: high level – if the student scored more than 19 points; average level – from 18 to 9 points (inclusive); all other test results corresponded to the "low level".

"High" level: the student is independent in determining the objectives of the study; rationally fits the definition of restrictions of various nature (material, social, etc.); recognizes the social significance of the simulated object/phenomenon; effectively allocates available resources in the course of practical implementation; applies interdisciplinary knowledge that goes beyond the scope of a technical profile; highlights the relationship between the elements in the designed system and the conditions for their manifestation; defends its presentation of the model, the concept of the project, the design decision with reason; owns techniques, methods of working with 3D technology; can reasonably select the most effective (both 3D technology tools and techniques) for designing, developing a “smart product”; qualitatively prepares the results in the form of an engineering book or technical task for the Customer.

"Average" level: the student is not always able to independently formulate research objectives; not for all resource constraints is able to carry out model development; not fully aware of the potential of the simulated object/phenomenon; shows insufficiently deep and systemic interdisciplinary knowledge; highlights not all the relationships between elements in the designed system and the conditions for their manifestation; not always reasonably defends his view of the model, project concept, design solution; knows the techniques, methods of working with 3D

technology, but makes one or two non-critical errors in reasoning when substantiating their choice for designing, developing a "smart product"; when processing the results, he fulfills the basic technical requirements.

In other cases, the level of engineering thinking was defined as "low".

4.3.3. Control stage of the experiment

At the control stage of the experiment, we carried out another assessment, which also contained 10 test questions developed according to the previously described principle. In the final control testing, the teacher took into account the difficulties faced by the participants when formulating the questions. For example, to determine those functions of the designed engineering solution that will be redundant; what 3D technology tools are best used in the restrictions specified by the Customer; choose from the list those compromises that you are ready to make when developing; choose the model from a set of three-dimensional images, which may be the prototype of some product; suggest options for improving the mechanism, etc.

To verify the reliability of results, we applied the criterion of G characters and used an online calculator and statistical tables (Ostapenko, 2010). Let us formulate hypotheses for the experimental group:

H0: the shift in increasing the level of formation of personality skills, which form the basis of engineering thinking, after the teacher implements directions for supporting the research activities of students in 3D modeling, is random.

H1: a shift in increasing the level of formation of personality and personal skills, which form the basis of engineering thinking, after the teacher has implemented areas of support for the research activities of students in 3D modeling, is not random.

The results of the control assessment for students of the experimental group are presented in Table 1.

Table 1. The results of the test in the experimental group

Level	Before the experiment	After the experiment	Positive Shifts	Negative shifts	Null shifts	Total of non-null shifts
High	1	4	0	0	1	0
Average	28	34	22	2	4	24
Low	11	2	11	0	0	11
Total of shifts			33	2	5	35

The values in the columns "Positive shifts", "Negative shifts", "Null shifts" allow to present in dynamics the qualitative changes in the level of formation of personal skills, which form the basis of engineering thinking. In the corresponding parts of the table we have 5 «null» (discarded shifts), 33 «positive» (typical shifts), 2 negative (atypical) shifts. According to the requirements of the criterion, only "non-null" shifts are taken into account, and null shifts are discarded. Performing the analysis of the values of the statistical tables for the criterion of G characters and online calculations, we conclude that for n=33 (in accordance with the number of "typical" shifts) the following is true:

$$G_{cr} = \begin{cases} 11, \text{if } p = 0.05 \\ 9, \text{ if } p = 0.01 \end{cases}$$

According to empirical measurements, Gemp = 2. Thus, Gemp < Gcr. Therefore, the hypothesis is inclined to the alternative hypothesis H1, i.e. a shift in increasing the level of formation of personal skills that form the basis of engineering thinking, after the teacher has implemented areas of support for research activities of students in 3D modeling in the experimental group, is not random.

Let us formulate hypotheses for the control group:

H0: a shift in the increase in the level of formation of skills of the personality, which form the basis of engineering thinking, after training, is random.

H1: a shift in increasing the level of formation of skills of the personality, which form the basis of engineering thinking, after training, is not random.

The test results for the control group are presented in Table 2.

Table 2. The results of the test in the control group

Level	Before the experiment	After the experiment	Positive shifts	Negative shifts	Null shifts	Total of non-null shifts
High	1	1	0	0	1	0
Average	27	34	13	7	7	20
Low	11	4	9	0	2	9
Total of shifts			22	7	10	39

In the corresponding parts of the table we have 10 "null" (discarded shifts), 22 "positive" (typical shifts), 7 negative (atypical) shifts. According to the requirements of the criterion, only "non-null" shifts are taken into account, and null shifts are discarded. Performing an analysis of the values of the statistical tables for the criterion of G characters and online calculations, we conclude that for n = 22 (in accordance with the number of "typical" shifts) the following is true:

$$G_{cr} = \begin{cases} 6, \text{ if } p = 0.05 \\ 5, \text{ if } p = 0.01 \end{cases}$$

According to empirical measurements, Gemp = 7. Gemp > Gcr, then the hypothesis H0 is accepted, that is, a shift in increasing the level of formation of personal skills, which form the basis of engineering thinking, after training in the control group, is random.

Discussion

The sample was not probabilistic, since the experimental and control groups were formed in such a way as to ensure the presence of the same skills and personality traits that form the basis of engineering thinking, their equal distribution in each group.

Throughout the experiment, work on three-dimensional modeling, attracting students to research with 3D technology was carried out by the same teacher, on the same software equipment in special informatics rooms.

Performing a quantitative analysis of the above results, we can conclude that after the experiment was completed, 10 % of the students in the experimental group had a high level of formation of basic properties that form the basis of engineering thinking, while initially this percentage was 3 %. In the control group, the proportion of students with a high level of development of engineering thinking remained unchanged (the value of the indicator is 3 % before and after the experiment). The dynamics of values at other levels in the experimental group also testifies to a qualitative improvement in learning indicators and the formation of monitored personality traits (see Figure 1).

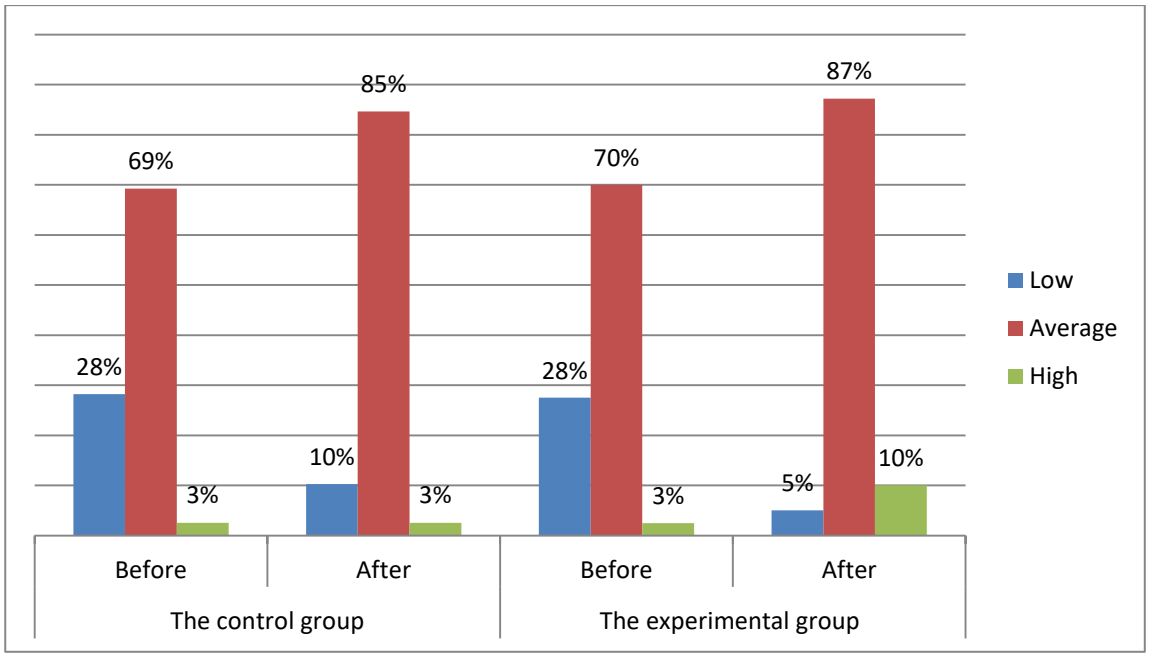


Fig. 1. Dynamics of changes in the level

Thus, in the course of completing technical tasks on three-dimensional modeling, students systematized the necessary conceptual apparatus, studied various functional capabilities of software environments and 3D printing devices, got the opportunity to solve specific practical and socially significant problems of the future, while showing independence in choosing 3D tools, methods of cognition. We can conclude that the differences in the levels of engineering thinking are due precisely to the use of 3D modeling tools and methods as an effective pedagogical teaching technology. The presentation of ready-made three-dimensional models to potential employers of the city of Kirov confirmed the importance of inventions, as many of them expressed their willingness to assist in organizing and conducting industrial internships, student training practices, as well as to collaborate in the development and implementation of new educational programs for future professions to prepare highly qualified specialists Industry 4.0 when providing additional information.

5. Conclusion

In the process of three-dimensional modeling, students create 3D objects according to working drawings and technical documentation, participate in the development of design documentation for the product; perform visualization and texturing of objects, analyze simulated products for technicality, generate and improve engineering solutions; carry out the presentation of the project with oral support and justification of social significance. Objects for 3D modeling can be abstract, or they can correspond to the real problems of society, economics, science (resource saving, life safety, architecture, film and video industry, etc.). Work in 3D spaces is emotionally attractive for students, supports the development of high-order thinking processes, professional self-determination and allows to get skills that are in demand on the labor market.

Thus, the results of the study prove that 3D technologies have a powerful educational potential in terms of improving the training of a high-demand “engineer of the future”, capable of self-development and professional self-realization, ready to solve non-standard tasks of Industry 4.0, with experience in predicting the results of upcoming activities and oriented towards universal human values.

For the successful implementation of the proposed areas and the use of 3D technology in the formation of engineering thinking, it is recommended to have the following set of conditions: building the educational process based on the integration of fundamental scientific theories and software/digital technologies; implementation of interdisciplinary research tasks of a problematic nature with a focus on the challenges of Industry 4.0; actualization of the needs of students in

obtaining a high-demand profession of the future through the practice of 3D modeling activities, collaboration. When forming engineering thinking using 3D technology, we should remember that the corresponding activity involves the integration of innovative, technical, economic and constructive components. Distinctive features of the "engineer of the future" are:

–the ability to see the structure when it is not visible to humans, without engineering thinking. The engineer of the future should see all sorts of interconnections between elements in the system, as well as the conditions in which they appear and disappear;

–the ability to be effective in conditions of restrictions that may be determined by nature (climate, physical laws, resistance of materials) or by a person (human behavior, constitution, finances);

–ability to identify priority tasks in the project and efficiently allocate resources.

The results can be used to improve the quality of teaching 3D modeling in a digital school due to specially organized areas of support for creative, intersectoral, cognitive research activities of students, focused on the development of engineering thinking, and carried out in the conditions of training for the formation of Industry 4.0.

References

Benzer, Yildiz, 2019 – *Benzer, A.I., Yildiz, B.* (2019). The effect of computer-aided 3D modeling activities on pre-service teachers' spatial abilities and attitudes towards 3d modeling. *Journal of Baltic Science Education*. 18(3): 335-348. DOI: https://doi.org/10.33225/jbse/19.18.335

Chugunov, Polunina, 2018 – *Chugunov, M., Polunina, I.N.* (2018) Mezhdistsiplinarnoe modelirovanie robotov s ispol'zovaniem sistem avtomatizirovannogo proektirovaniya. [Interdisciplinary modelling of robots using CAD/CAE technology]. *Vestnik Mordovskogo universiteta*. 28 (2): 181-190. DOI: https://doi.org/10.15507/0236-2910.028.201802 [in Russian]

Concepción et al., 2018 – *Concepción, V., Rebollar, C., García, O., Bravo, F, Bilbao, J.* (2019). Skills in computational thinking of engineering students of the first school year. *Heliyon*. 5: n. pag. DOI: https://doi.org/10.1016/j.heliyon.2019.e02820

Damyanov, Tsankov, 2018 – *Damyanov, I., Tsankov, N.* (2018). The Role of Infographics for the Development of Skills for Cognitive Modeling in Education. *International Journal of Emerging Technologies in Learning (iJET)*. 13(01): 82. DOI: https://doi.org/10.3991/ijet.v13i01.7541

Huang et al., 2019 – *Huang, T.-Ch., Chen, M.-Y., Lin, Ch.-Y* (2019). Exploring the behavioral patterns transformation of learners in different 3D modeling teaching strategies. *Computers in Human Behavior*. 92: 670-678. DOI: https://doi.org/10.1016/j.chb.2017.08.028

Huang, Lin, 2017 – *Huang, T.-Ch., Lin, Ch.-Y.* (2017). From 3D modeling to 3D printing. *Telematics and Informatics*. 34 (2): 604-613. DOI: https://doi.org/10.1016/j.tele.2016.10.005

Hutchison et al., 2020 – *Hutchison, K., Paatsch, L., Cloonan, A.* (2020). Reshaping home–school connections in the digital age: Challenges for teachers and parents. *E-Learning and Digital Media*. 17(2): 167-182. DOI: http://dx.doi.org/10.1177/2042753019899527

Ignatova, Filimontseva, 2019 – *Ignatova, T.V., Filimontseva, E.M.* (2019). Higher education impact onto development of innovative thinking of managers. *Revista ESPACIOS*. 40(21). [Electronic resource]. URL: https://ssrn.com/abstract=3496342

Ilomäki, Lakkala, 2018 – *Ilomäki, L., Lakkala, M.* (2018). Digital technology and practices for school improvement: innovative digital school model. *Research and Practice in Technology Enhanced Learning*. 13: 25. DOI: https://doi.org/10.1186/s41039-018-0094-8

Isaev, Plotnikov, 2019 – *Isaev, A.P., Plotnikov, L.V.* (2019). Technology for Training Creative Graduates in Engineering Bachelor's Programs. *Vysshee obrazovanie v Rossii*. 28(7): 85-93. DOI: https://doi.org/10.31992/0869-3617-2019-28-7-85-93

Karakozov, Ryzhova, 2019 – *Karakozov, S.D., Ryzhova, N.I.* (2019). Information and Education Systems in the Context of Digitalization of Education. Journal of Siberian Federal University. *Humanities & Social Sciences*. 12(9): 1635-1647. DOI: https://doi.org/10.17516/1997-1370-0485

Khutorskoy, 2017 – *Khutorskoy, A.V.* (2017). Metodologicheskie osnovaniya primeneniya kompetentnostnogo podhoda k proektirovaniyu obrazovaniya [Methodological basis for the use of competence-based approach to the design of education]. *Vysshee obrazovanie v Rossii*. 12(218):

85-91. [Electronic resource]. URL: https://vovr.elpub.ru/jour/article/view/1228/1047 (date of access: 01.06.20). [in Russian]

Kudryavtsev, Yakimanskaya, 1964 – *Kudryavtsev, T.V., Yakimanskaya, I.S.* (1964). K probleme izucheniya tekhnicheskogo myshleniya [To the problem of studying technical thinking]. *Voprosy psikhologii*. 4: 3-19. [Electronic resource]. URL: http://elar.rsvpu.ru/bitstream /123456789/2653/1/vestnik_23_07.pdf [in Russian]

Lin et al., 2020 – *Lin, L., Shadiev, R., Hwang, W., Shen, S.* (2020). From knowledge and skills to digital works: An application of design thinking in the information technology course. *Thinking Skills and Creativity*. 36. DOI: http://dx.doi.org/10.1016/j.tsc.2020.100646

Martyakova, Gorchakova, 2019 – *Martyakova, E., Gorchakova, E.* (2019). Quality Education and Digitalization of the Economy. *Proceedings of the 4th International Conference on the Industry 4.0 Model for Advanced Manufacturing. Cham: Springer International Publishing*, 212-218. [Electronic resource]. URL: http://link.springer.com/10.1007/978-3-030-18180-2_17 (date of access: 12.03.2020).

Molano, 2020 – *Molano, T.C.* (2020). The skills of pre-service teachers of region II, philippines in the 21st century. *International Journal of Scientific and Technology Research*. 9(2): 4108-4110.

Mudrakova, Latushkina, 2020 – *Mudrakova, O.A., Latushkina, S.A.* (2020). Ispol'zovanie didakticheskikh vozmozhnostei 3d-modelirovaniya dlya razvitiya prostranstvennogo myshleniya obuchayushchikhsya [Using didactic capabilities of 3d modeling for the development of spatial thinking of students]. *Voprosy pedagogiki*. 1(1): 139-144. [Electronic resource]. URL: https://www.elibrary.ru/item.asp?id=41804676

Novak, Wisdom, 2018 – *Novak, E., Wisdom, S.* (2018). Effects of 3D Printing Project-based Learning on Preservice Elementary Teachers' Science Attitudes, Science Content Knowledge, and Anxiety About Teaching Science. *Journal of Science Education and Technology*. 27(5): 412-432. [Electronic resource]. URL: http://link.springer.com/10.1007/s10956-018-9733-5 (date of access: 10.06.2020).

Ostapenko, 2010 – *Ostapenko, R.I.* (2010). Matematicheskie osnovy psihologii [Mathematical foundations of psychology]. Voronezh: VGPU. 76 p. [in Russian]

Paterson, 2017 – *Paterson, R.E.* (2017). Intuitive cognition and models of human–automaton interaction. *Human Factors: The Journal of the Human Factors and Ergonomics Society*. 59(1): 101-115. DOI: doi/10.1177/0018720816659796

Perelet, 2019 – *Perelet, R.A.* (2019). Environmental Issues in a Digital Economy. *The World of New Economy*. 12(4): 39-45. DOI: https://doi.org/10.26794/2220-6469-2018-12-4-39-45

Ranger, Mantzavinou, 2018 – Ranger, B., Mantzavinou, A. (2018). Design thinking in development engineering education: A case study on creating prosthetic and assistive technologies for the developing world. *Development Engineering*. 3: 166-174. DOI: https://doi.org/10.1016/ j.deveng.2018.06.001

Rodríguez-Martín et al., 2019 – *Rodríguez-Martín, M., Rodríguez-Gonzálvez, P., Sánchez-Patrocinio, A. Sánchez, J.R.* (2019). Short CFD simulation activities in the context of fluid-mechanical learning in a multidisciplinary student body. *Applied Sciences (Switzerland)*. 9(22): 4809. DOI: https://doi.org/10.3390/app9224809

Rozhik, 2017 – *Rozhik, A.Ju.* (2017). Istoricheskie etapy resheniya problemy formirovaniya inzhenernogo myshleniya [Historical stages of engineering thinking formation]. *Vestnik Yuzhno-Ural'skogo gosudarstvennogo universiteta. Seriya: Obrazovanie. Pedagogicheskie nauki*. DOI: https://doi.org/10.14529/ped170210

Sánchez et al., 2019 – *Sánchez, A., Gonzalez-Gaya, C., Zulueta, P., Sampaio, Z.* (2019). Introduction of Building Information Modeling in Industrial Engineering Education: Students' Perception. *Applied Sciences*. 9 (16): 3287. DOI: https://doi.org/10.3390/app9163287 (date of access: 12.06.2020).

Soboleva i dr., 2020 – *Soboleva, E.V., Isupova, N.I., Karaulova, L.V., Nimatulaev, M.M.* (2020). Razvitie ekologicheskogo myshleniya i navyka berezhlivogo proizvodstva v kurse mobil'noi robototekhniki [Development of environmental thinking and lean manufacturing skills in the course of mobile robotics]. *Science for Education Today*. 10 (1): 149-173. DOI: http://dx.doi.org/10.15293/2658-6762.2001.09

Soboleva i dr., 2020a – *Soboleva, E.V., Suvorova, T.N., Zenkina, S.V., Gerasimova, E.K.* (2020). Razvitie kriticheskogo myshleniya cherez vovlechenie uchashchikhsya v sorevnovatel'nuyu robototekhniku (iz opyta raboty) [The development of critical thinking through the involvement of pupils in competitive robotics (from work experience)]. *Perspektivy nauki i obrazovania*. 44(2): 268-284. DOI: 10.32744/pse.2020.2.21

Soboleva, 2019 – *Soboleva, E.V.* (2019). Model' izucheniya robototekhniki na primere tekhnologii smeshannogo obucheniya «perevyornutyj klass» [Robotics learning model on the example of blended learning "flipped classroom"]. *Perspektivy nauki i obrazovaniya*. 4(40): 155-168. DOI: https://doi.org/10.32744/pse.2019.4.13 [in Russian]

Soboleva, Fedotenko, 2019 – *Soboleva, M.L., Fedotenko, M.A.* (2019). Mobil'noe obuchenie, mobil'noe prilozhenie, elektronnyi obrazovatel'nyi resurs, sredstvo obucheniya: sut' i vzaimosvyaz' ponyatii [Mobile learning, mobile application, electronic educational resource, learning tool: essence and interrelation of concepts]. *Informatika v shkole*. 9: 42-48. DOI: https://doi.org/10.32517/2221-1993-2019-18-9-42-48 [in Russian]

Stolbova i dr., 2019 – *Stolbova, I.D., Aleksandrova, E.P., Kochurova. L.V., Nosov, K.G.* (2019). Profil'nye aspekty graficheskogo obrazovaniya v politekhnicheskom vuze [Profile aspects of graphic education at a polytechnic university]. *Vysshee obrazovanie v Rossii*. 3: 155-166. DOI: https://doi.org/10.31992/0869-3617-2019-28-3- [in Russian]

Suvorova, Mikhlyakova, 2020 – *Suvorova, T.N., Mikhlyakova, E.A.* (2020). Primenenie tekhnologii 3D-modelirovaniya dlya personalizatsii obucheniya [The use of 3D modeling technologies for personally oriented learning]. *Kontsept*. (5): 110-129. [Electronic resource]. URL: http://e-koncept.ru/2020/201038.htm [in Russian]

Szymanski, 2018 – *Szymanski, A.* (2018). Prototype Problem Solving Activities Increasing Creative Learning Opportunities Using Computer Modeling and 3D Printing. *Creativity and Technology in Mathematics Education. Cham: Springer International Publishing*. 10: 323-344. [Electronic resource]. URL: http://link.springer.com/10.1007/978-3-319-72381-5_13 (date of access: 12.02.2020).

Tepavčević, 2017 – *Tepavčević, B.* (2017). Design thinking models for architectural educationю. *The Journal of Public Space*. 2(3): 67-72. DOI: http://dx.doi.org/10.5204/jps.v2i3.115

Terzidou et al., 2018 – *Terzidou, T., Tsiatsos, T., Apostolidis, H.* (2018). Multimed Architecture and interaction protocol for pedagogical-empathic agents in 3D virtual learning environments. *Multimedia Tools and Applications*. 77: 27661. DOI: https://doi.org/10.1007/s11042-018-5942-4

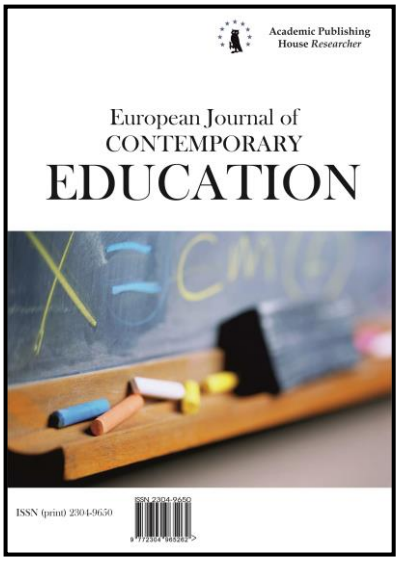
Tocháček et al., 2016 – *Tocháček, D., Lapeš, J., Fuglík, V.* (2016). Developing Technological Knowledge and Programming Skills of Secondary Schools Students through the Educational Robotics Projects. *Procedia – Social and Behavioral Sciences*. 217: 377-381. DOI: https://doi.org/10.1016/j.sbspro.2016.02.107

Usoltsev, Shamalo, 2015 – *Usoltsev, A.P., Shamalo, T.N.* (2015). Formirovanie innovatsionnogo myshleniya shkol'nikov v uchebnom protsesse.. [Developing the innovative mentality of secondary school students]. *Obrazovanie i nauka*. 1. 17-30. DOI: https://doi.org/10.17853/1994-5639-2014-4-17-30 [in Russian]

Varshavskaya, Kotyrlo, 2019 – *Varshavskaya, E., Kotyrlo, E.S.* (2019). Vypuskniki inzhenerno-tekhnicheskikh i ekonomicheskikh spetsial'nostei: mezhdu sprosom i predlozheniem. [Graduates in engineering and economics: between demand and supply]. *Voprosy obrazovaniya*. 2: 98–128. DOI: https://doi.org/10.17323/1814-9545-2019-2-98-128 [in Russian]

Wei et al., 2019 – *Wei, L., Lu, K., Zhang, X.* (2019). The Structure Model of E-Learning Support System for Innovative Talents Training Environment. *Ekoloji Dergisi*. 107: 4313-4320. [Electronic resource]. URL: https://www.researchgate.net/publication/279845092_Structure_Oriented_Evaluation_Model_for_E-Learning

Published in the Slovak Republic
European Journal of Contemporary Education
E-ISSN 2305-6746
2020, 9(3): 546-551
DOI: 10.13187/ejced.2020.3.546
www.ejournal1.com



Phubbing Behavior: Is There a Gender Difference in College Students?

Milka Elena Escalera-Chávez [a], Arturo García-Santillán [b, *], Violeta S. Molchanova [c, d]

[a] Unidad Académica Multidisciplinaria Zona Media, UASLP, México
[b] UCC Business School at Universidad Cristobal Colon, México
[c] International Network Center for Fundamental and Applied Research, Washington, USA
[d] Volgograd State University, Volgograd, Russian Federation

Abstract

When a person is ignored for other one in a social context for the focus given to the use of a mobile phone, it is called phubbing. This phenomenon is increasingly recurring in society and students are not exempt from it. For this reason, the aim of this research is to determine if there is a difference in phubbing behavior between male students and female students from the Mid-Zone Multidisciplinary Academic Unit. This study was carried out by surveying 243 Business Administration college students in the Multidisciplinary Academic Unit of the Middle Zone, whose ages range from 17 to 26 years. The test designed by Chotpitayasunondh and Douglas, (2016) was used. From this questionnaire, only those corresponding to demographic characteristics, Phubbing intensity and Phubber intensity, were taken. For the data analysis, a Bayesian analysis was used with Bayes' Theorem as a central point. The main result reported in this work reveals that the difference in Phubbing behavior between men and women is significant. This assertion is given from the data obtained from the Bayesian Factor, which measured the probability that the phenomenon occurred. Therefore, we can say that the result shows a moderate difference in Phubbing behavior between male students and female students. The value obtained from the Bayesian analysis confirms that there is a 4.959 probability of obtaining a higher average in men than in women.

Keywords: Phubbing, behavior, college students.

1. Introduction

In recent decades, there has been a significant growth in the use of mobile internet, due to the arrival of smartphones and tablets; as a result, more users access the internet from their smartphones. This social trend has modified the way of communicating, since it allows contact

* Corresponding author
E-mail addresses: agarcias@ucc.mx (A. García-Santillán)

between people from anywhere in the world, facilitating social interactions. Serrano (2014) points out, that nowadays great connectivity has been achieved, lasting longer every time, and this leads to people staying online through mobile devices and other platforms, transforming this into a social and working necessity.

Current studies show that 81 % of smartphone users navigate the Internet, from which 77 % use it to search for information, 68 % to access their applications and 48 % to view videos on their mobile. Other important data includes the fact that 72 % of smartphone users use their device while consuming other media, 93 % access the internet from their mobiles while at home and 90 % of respondents used their smartphones during their most recent social activity (Ranie, Zickuhr, 2015).

In Mexico, the National Survey on Availability and Use of Information Technologies in Households (ENDUTIH, 2017) show that mobile phones have become one of the technologies most widely used by the population. Accordingly, 42 % are owners of a mobile phone, which is used for different activities such as checking social networks, listening to music, surfing the internet and mobile banking, among others, not just to keep in touch. Of the total number of people who own a smartphone, 65 % indicated the amount of time they actively use it and the daily average time is 5 hours and 32 minutes.

The National Institute of Statistics, Geography and Informatics (INEGI for its acronym in Spanish) in 2017, reported that in Mexico the use of smartphones grew from 60.6 million in the year of 2016 to 64.7 million in 2017, while also increasing the number of users who access the internet from a smartphone. The increase went from 89 % in 2016 to 92 % in 2017. Moreover, 36.4 million of smartphone users installed applications on their phones: 92.1 % installed instant messaging, 79.8 % tools for accessing social networks, 69.7 % installed audio and video content applications, while 16.0 % used their device to install an application to access mobile banking.

Despite their advantages, it is a fact that these devices are capable of separating people (Turkle, 2012, cited by T'ng, Ho, Low, 2018). This factual behavior of society is defined as phubbing, a word defined by the Macquarie Dictionary, which shaped the expression by merging the words phone and snubbing. The dictionary describes it as an act of contempt towards someone in a social environment as a result of being focused on the mobile phone. Instead of communicating in close proximity, this phenomenon, that is increasingly frequent in all strata of society, makes phone users more determined to give more priority to the smartphone than to any situation happening in their surroundings.

Regarding students, 96.7 % have heard about the "phubbing" concept and they believe that this phenomenon will be increasingly popular because these devices have more applications every day. On the other hand, more than 70 % of college students said that they mainly use their phones to communicate, listen to music, watch videos and social networks, even though 40 % of students said they prefer face-to-face communication.

Nonetheless, it can be said that there is an increasing trend towards the use of mobile phones, making this preference the basis of phubbing. The phenomenon of phubbing occurs in both males and females. On this matter, some studies (Chotpitayasunondh, Douglas, 2018) have shown that there are significant differences between genders.

Some studies, such as the ones by Cameron & Webster (2011), Ranie & Zickuhr (2015), Abeele, Antheunis, & Schouten (2016), Misra, Cheng, Genevie & Yuan (2014), Krasnova, Abramova, Notter & Baumann (2016) and Roberts & Meredith (2017), have studied the effects of phubbing. In the works, showing that this phenomenon generates different negative reactions such as anger, poor quality interactions, dissatisfaction, loss of confidence and disappointment since people feel less close to the partner with whom they are having an interaction. Furthermore, the excessive use of the mobile phone causes various pathologies such as: lack of operating memory, eye and hearing problems, headache and back pain, poor body posture, thumb injuries and carpal tunnel syndrome.

Phubbing is a behavior increasingly present among students, as well as in society in general. This behavior can become a standard of conduct that can be detrimental to the training of students, as more and more young people make use of the benefits of smartphones. These benefits stir them to their particular interests and therefore, there is a high demand for smartphones and a very high possibility of engaging in phubbing behavior. Because of the former, the purpose of this study is to

determine if there is a difference in phubbing behavior between male and female students of the Multidisciplinary Academic Unit of the Middle Zone.

2. Methods

The study is approached from the deductive-hypothetical paradigm; it is of non-experimental design because there is no manipulation of the independent variables (X) to modify the dependent effect (Y). According to its temporality, data collection, analysis and scope, it is cross-sectional, correlational and explanatory. The reason why the hypothetical-deductive method was implemented is given from the data obtained from the college students, since it was possible to create assumptions that explain whether there is a difference in relation to gender regarding phubbing behavior.

Therefore, the hypothesis to be tested is: H0: There is no difference in phubbing behavior among male and female college students. H1: There is no difference in phubbing behavior among male and female college students.

Type of study. According to the characteristics of the sample, and considering that it is a non-experimental design, the study begins as descriptive and concludes as explanatory, since it is focused on explaining whether there is a difference in relation to gender between phubbing behavior among students.

Participants. The type of sample used is non-probabilistic, because the choice of cases depended on probability, but on causes related to the characteristics of the investigation. 243 students from the Bachelor of Administration of the Multidisciplinary Academic Unit of the Middle Zone, whose ages ranged from 17 to 26, were surveyed during the semester from January 2018 to July 2018. This higher education institution is located in the city of Rioverde, San Luís Potosí, México.

Instrument-Test. To obtain the data, the test designed by Chotpitayasunondh and Douglas, (2016) was used, which is integrated into seven sections: Intensity of Phubbing, Intensity of being Phubber, Perceived norms of the Phubbing Phenomenon, Scale of self-control (BSCS), Internet Addiction (IAT), Smartphone Addiction (SAS-SV) and Fear of Missing (FoMOS). From this questionnaire, only those corresponding to demographic characteristics, Phubbing intensity and Phubber intensity, were taken.

The questionnaire contains items to measure the frequency with which one subject ignores another for the use of a cell phone. Items are rated as: (1) never, (2) less frequently, (3) once a week, (4) 2 or more times a week, (5) once a day, (6) 2 to 3 times a day, (7) 4 to 5 times a day, (8) 6 to 9 times a day, (9) 10 or more times a day. Due to the small number of participants in some response categories, the nine categories were reduced to four (less frequently, less than once a day, 1–3 times a day and 4 or more times a day).

On the other hand, to measure the length of time that a person ignored someone else to answer a cell phone call, it was measured using items within the following range: (1) less than 15 min, (2) 15–30 min, (3) 30–60 min, (4) 60–90 min, (5) 90–120 min, (6) 2–3 hours, (7) 4–6 hours, (8) more than 6 hours. Again, due to the low frequency of some options, we reduced the duration categories by just four (less than 15 min, less than an hour, between 1–2 hours, and more than 2 hours). The phubbing frequency and the phubbing duration were added together to create a score for the overall phubbing behavior.

Statistic procedure. To measure data, the Bayesian methodology was used. This statistic method is based in the interpretation of subjective probability and has the Bayes theorem as central idea.

$$P(H \mid D) = \frac{P(D \mid H) \cdot P(H)}{P(D)}. \quad (1)$$

Where:
P (H1) = Probability of the difference or association hypothesis (veracity).
P (H0) = Probability of no difference or no association.
P(H/D): Probability (hypothesis/data)
P(D/H): Probability (data/hypothesis)

P(H): Probability hypothesis
P(D): Probability data

Bayes' theorem provides a natural way to test hypotheses. The alternative hypothesis assumes that: H1: There is a difference in phubbing behavior between male and female students and the null hypothesis H0: There is no difference in phubbing behavior between male students and female students. The subsequent probabilities of H1 and H0 are directly compared in favor of H1 over H0 as P (H1 | D) / P (H0 | D). To do this, Bayes' theorem is used (Equation 1).

$$\underbrace{\frac{P(H_1 \mid D)}{P(H_0 \mid D)}}_{\text{posterior odds}} = \underbrace{\frac{P(D \mid H_1)}{P(D \mid H_0)}}_{\text{Bayes factor}} \cdot \underbrace{\frac{P(H_1)}{P(H_0)}}_{\text{prior odds}} .$$

Specifically, the subsequent probabilities are equal to the prior probabilities multiplied by an update factor. This update factor is equal to the ratio of probabilities P (D | H1) and P (D | H0), and is called the Bayes factor (Jeffreys, 1961). Intuitively, the Bayes factor can be interpreted as the weight of the evidence provided by a D data set.

Páez, Lozano, Dávila, (2011) point out that the Bayesian inference -by using the Bayes theorem – allows assigning to priori, probabilities about events that are not necessarily random in nature. In this way, it is necessary to know the occurrence of some event in some experiment, which would allow reformulating the probability (subjective probability). Therefore, these probabilities can be fine-tuned by using Bayes' theorem.

3. Discussion and results

Table 1 shows the descriptive statistics, in which the 95 % interval can be observed, indicating that we are 95 % sure that the difference in the mean phubbing behavior of 0.2759 is in the range of -0.1991 and 0.7510; therefore, it is considered to be in an acceptable range. In the table we have the Bayes factor (BF = 4.959), which is the measurement of the relative probability between two hypotheses, indicating that the data occurred 4.959x is more likely to occur in hypothesis H1 than under H0.

Table 1. Independent sample test of Bayes factor (Method=Router)

Phubbing	Means differences	Standard grouped error differences	Bayes factor	t	df	Sig. (bilateral)
	0.2759	0.24886	4.959	1.109	240	.269

Subsequent distribution characterization for independent sample mean

Phubbing	Subsequent Mode	Mean	Variance	95% Credible range Lower limit	Upper limit
	0.2759	0.2759	0.059	-.1991	.7510

Source: own

Now, in Figures 1 and 2 it shows the histograms of the distributions generated from the analysis. Because we use a non-informative prior, the probability of recording and subsequent distributions is similar.

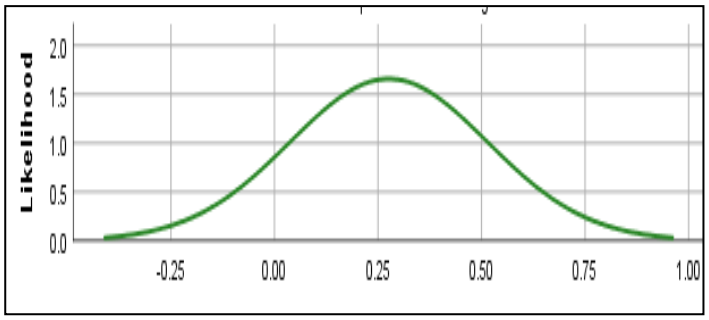


Fig. 1. Histograms of the mean distribution of the total Phubbing prior
Source: own

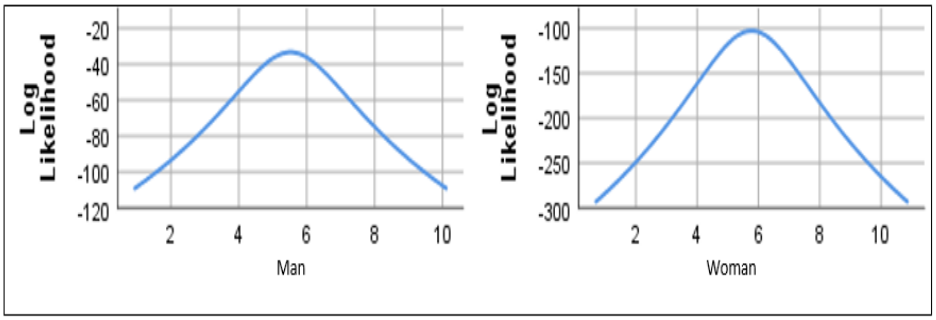


Fig. 2. Histograms of the mean between man and woman
Source: own

Figure 1 shows the previous distribution value of the mean difference (.254) between men and women of the Phubbing variable. Similar way in Graph 2 shows the distribution of the means difference between men and women a priori of the Phubbing variable, a difference between them is observed. The evaluation by the method of maximum likelihood tries to find the most probable values of the parameters of the distribution for a set of data, maximizing the value.

In summary, we can say that following our Bayesian analysis, we may say that the most probable difference between mean phubbing behavior is .2759; however, our Bayes Factor = 4.959, indicates that there is moderate evidence for H1, meaning that the alternate hypothesis is a more likely explanation for the data than the null. In other words, the difference in phubbing between men and women is significant, thus proving there is a difference between genders.

4. Conclusion

The objective of this research was achieved since it was possible to determine the prevailing difference in phubbing behavior between male and female students of the Multidisciplinary Academic Unit of the Middle Zone.

In the carried-out analysis, the Bayesian Factor (4,959) measured the occurrence probability of the phenomenon that was studied. As a consequence, the result indicates that there is moderate evidence of a difference in phubbing behavior between male and female students. It is important to point out that the complementary graphs offered by the Bayesian analysis show a moderate difference between the groups. Accordingly, the Bayesian analysis reports that there is a 4,959 probability of obtaining a higher average in men than in women.

The results are similar to previous studies done by Chotpitayasunondh & Douglas, 2018 and T'ng, Ho & Low, 2018, who have proven the significant differences between men and women.

It is recommended to analyze students from different careers and profiles, because it would allow us to determine if the effects of phubbing cause different negative reactions among students, as they are not being considered by the people with whom they are interacting face to face. Additionally, it also important to do this type of study to measure the magnitude of this behavior, derived from the current social trend because often, due to lack of knowledge, strategies cannot be set in place to avoid undesired effects on students.

References

Abeele et al., 2016 – *Abeele, M.M.V., Antheunis, M.L., Schouten, A.P.* (2016). The effect of mobile messaging during a conversation on impression formation and interaction quality. *Computers in Human Behavior*. 62: 562-569.

Cameron, Webster, 2011 – *Cameron, A.F., Webster, J.* (2011). Relational outcomes of multicommunicating: Integrating incivility and social exchange perspectives. *Organization Science*. 22(3): 754-771.

Chotpitayasunondh, Douglas, 2018 – *Chotpitayasunondh, V., Douglas, K.M.* (2018). The effects of "phubbing" on social interaction. *Journal of Applied Social Psychology*. 48(6): 304-316.

Delbridge et al., 1981 – *Delbridge, A., Bernard, J.R., Blair, D.* (1981). The Macquarie Dictionary. Sydney: Macquarie Library.

ENDUTIH, 2017 – ENDUTIH (2017). Encuesta Nacional sobre Disponibilidad y Uso de Tecnologías de la Información en los Hogares. [Electronic resource]. URL: https://www.inegi.org.mx/programas/dutih/2017/

INEGI, 2017 – INEGI (2017). Comunicado de Prensa No. 105/18 20 DE FEBRERO DE 2018, 1-2. [Electronic resource]. URL: https://www.inegi.org.mx/contenidos/saladeprensa/boletines/2018/OtrTemEcon/ENDUTIH2018_02.pdf

Krasnova et al., 2016 – *Krasnova, H., Abramova, O., Notter, I., Baumann, A.* (2016). Why phubbing is toxic for your relationship: understanding the role of smartphone jealousy among "Generation *Y*" users. *Research Papers*. 109. [Electronic resource]. URL: http://aisel.aisnet.org/ecis2016_rp/10

Misra et al., 2014 – *Misra, S., Cheng, L., Genevie, J., Yuan, M.* (2014). The iPhone effect: the quality of in-person social interactions in the presence of mobile devices. *Environment and Behavior*. 48(2): 275-298.

Morey et al., 2016 – *Morey, R.D., Romeijn, J.W., Rouder, J.N.* (2016). The philosophy of Bayes factors and the quantification of statistical evidence. *Journal of Mathematical Psychology*. 72: 6-18.

Páez et al., 2011 – *Páez, L.O.M., Lozano, M.R., Davila, J.A.R.* (2011). Descripción general de la Inferencia Bayesiana y sus aplicaciones en los procesos de gestión. *La simulación al servicio de la academia*. (2): 1-28.

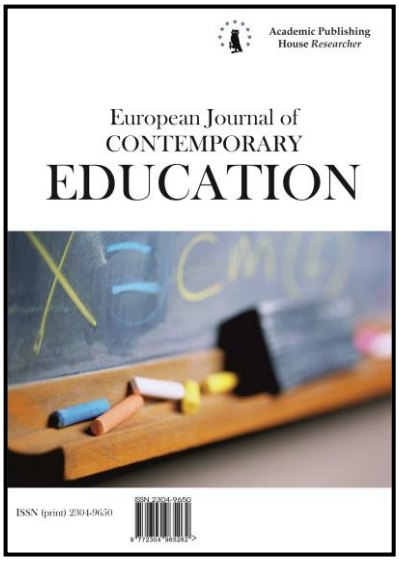
Ranie, Zickuhr, 2015 – *Ranie, L., Zickuhr, K.* (2015). Americans' Views on Mobile Etiquette. Washington DC: Pew Research Center.

Roberts, Meredith, 2017 – *Roberts, J., Meredith, D.* (2017). Partner Phubbing: How Cell Phones Impact Romantic. *Partnerships Keller Center Research Report*. (10): 2-8.

Serrano, 2014 – *Serrano, J.* (2014). Hacia una comunicación slow: el hábito de la desconexión digital periódica como elemento de alfabetización mediática. *Trípodos*. 34: 201-214.

T'ng et al., 2018 – *T'ng, S.T., Ho, K.H., Low, S.K.* (2018). ¿Are you "phubbing" me? The determinants of phubbing behavior and assessment of measurement invariance across sex differences. *International and Multidisciplinary Journal of Social Sciences*. 7(2): 159-190.

Published in the Slovak Republic
European Journal of Contemporary Education
E-ISSN 2305-6746
2020, 9(3): 552-571
DOI: 10.13187/ejced.2020.3.552
www.ejournal1.com



Application of Blockchain Technology in Higher Education

Elena P. Fedorova [a, *], Ella I. Skobleva [a]

[a] Astrakhan State University, Astrakhan, Russian Federation

Abstract

Emergence and development of the blockchain technology, which is able to transform into "a most powerful disruptive innovation", shall definitely concern universities. Moreover, nowadays the blockchain technology meets the challenges that both the system of higher education and the entire society are currently facing. Advantages of the blockchain technology are decentralized open data, absence of forgeries, safe storage of information, and reduction of transaction expenses related to data checkup, control, and verification.

This paper provides a critical analysis of application of the blockchain technology considering with its applicability opportunities and restrictions in education; it also aims to identify the consequences of its influence upon the development of education. The article analyzes real cases when this technology was applied, with the Massachusetts Institute of Technology (MIT) as an example. The MIT applied it to protect and validate the certificates that it issued. Another example is the Sony Global Education that forms individual data on its trainees' competencies and productivity; a third one relates to the University of Nicosia, which was the first to use smart contracts and accept cryptocurrency as a form of payment. The paper also considers the elements of the blockchain technology at universities (both in Russia and outside it), which participate in massive open online courses. It determines the scope of application of this technology in the Russian educational system. In addition, this article provides a literature review related to application of the blockchain technology; the review includes works by such renowned researchers as D. Tapscott, B. Bleir, A. Watters, A. Grech, A. Camilleri, M. Swan, A. Zaslavsky, etc. The paper analyzes the obtained findings of the survey that its authors have conducted among experts, professors, and specialists involved in accreditation.

Thus, the paper provides an analysis of opportunities and restrictions related to application of the blockchain technology in higher education.

Keywords: blockchain, higher education, smart contract, digitalization of education, massive open online courses, human capital, transactions, universities.

* Corresponding author
E-mail addresses: lenafedorova@mail.ru (E.P. Fedorova)

1. Introduction

Nowadays the world system of education is undergoing substantial changes related to the development of new technologies and digitalization of the educational environment. Education is becoming mass and personalized simultaneously. According to the global education market intelligence firm, HolonIQ, "population growth will be a key challenge for the Education sector. By 2035, there are expected to be 2.7 billion students worldwide", with slightly more than 500 million today (Spies, Brothers, 2020). The number of students will be growing thanks to Asian and African countries, where approximately 90 % of the population under 30 years old reside. Professional education is expected to apply digital technologies. The world market of education will have achieved approximately 10 trillion USD by 2030. The share of the compulsory 12-year education expenses (K-12) will be 5.5 trillion USD, whereas that of higher education will be 2.5 trillion USD (Spies, Brothers, 2020).

The current share of educational technologies (EdTech) at the world market of education is 3 %, or 165 billion USD (Rakhmanova, 2017). With the average annual growth rate of the market of educational technologies amounting to 17 %, expenses for educational technologies are expected to double by 2025, thus achieving approximately 314 billion USD.

An advantage of digital educational technologies is that personalized education becomes possible thanks to them. The current tendency is that trainees prefer to obtain a set of high-quality professional competences individually. According to Ed Clark, Vice President for Information Technology Services and CIO at the University of St. Thomas, present-day young people have already obtained a digital personality in addition to their real one (Rudich, 2020). Influence exerted upon a student's "digital personality" makes it possible to enhance the quality of education and increase the share of students who complete their studies successfully from 20 % (in the USA in average) to 60 % (at the University of St. Thomas).

The technologies of digital education make it possible to monitor how well a student has mastered new knowledge and skills, correct the learning process promptly; education becomes more personalized and flexible (Rudich, 2020).

Holon IQ determines four breakthrough technologies in the system of education (Spies, Brothers, 2020), expenses for which will have grown by 2025: augmented/virtual reality (AR/VR), artificial intelligence (AI), Robotics, and blockchain.

The blockchain technology presented in 2008 (Nakamoto, 2008) and initially applied to register cryptocurrency transactions is currently widely used in various nonfinancial activities.

Nevertheless, application of the blockchain technology in education is only at its initial stage; only a small number of educational institutions applies it now. At the same time, according to research findings, this technology has an outstanding potential in the sphere of higher education.

This article presents a Systematic Literature Review whose goal is to analyze the main trends and the structure of research activities in this field, as well as identify and systematize cases when the blockchain technology has been applied in the sphere of higher education.

2. Materials and methods

To analyze literature sources related to blockchain in higher education, we have used the Multivocal Literature Review (MLR), which is a form of Systematic Literature Review (SLR). MLR includes so-called grey literature (GL), which is information in news editions, in blogs, on web sites, and in official documents. This information is used as a supplement to reviewed academic literature published in journals, conference proceedings, and monographs.

The process of literature review consists of three stages: (1) development of the search line; (2) application of the search line in selected search engines; (3) extraction of documents based on determined criteria.

We have used the following words and phrases in the search line: blockchain, higher education, universities, smart contracts, blockchain in education. At the next stage, the search line has been applied to the following academic search engines: Scopus, Web of Science, Scholar Google, Science Direct, SpringerLink, JSTOR, SSRN, and arXiv. At the third stage, we have searched by headings, abstracts, contents of both academic and grey literature, beginning with the initial page of search results. If any materials did not correspond to the search requirements, they were expelled from our analysis.

The extracted data have been systematized by groups of themes: application, advantages, problems, and prospects. For grey literature, the following quality criteria have been applied: a publication has an author and a data-line; its publisher is known; this source is supported with trustworthy and well-documented references; its author has published other works in this field.

We have analyzed types of academic search engines and databases.

1. In such databases as Web of Science, Scopus, SpringerLink, we have found 2,131 sources by applying the phrase "blockchain in education" as for April 30, 2020. Figure 1 presents their content type distribution.

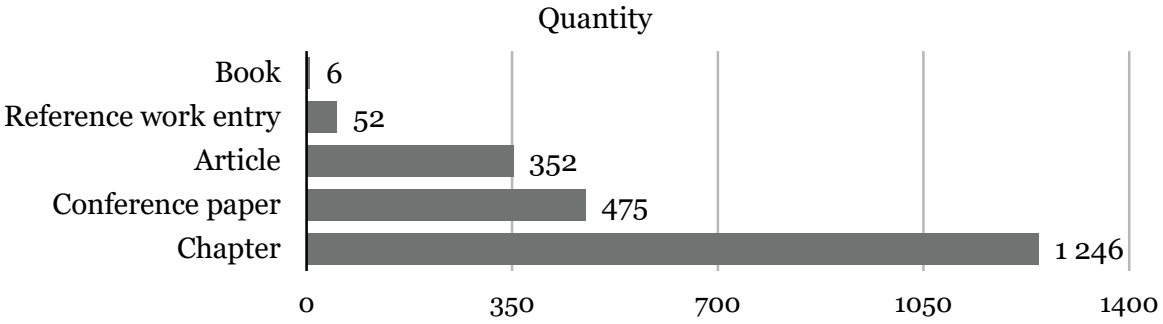


Fig. 1. Content type distribution

A majority of articles that consider application of blockchain relate to six fields of science: Computer Science, Engineering, Business and Management, Finance, Economics, Education (See Figure 2).

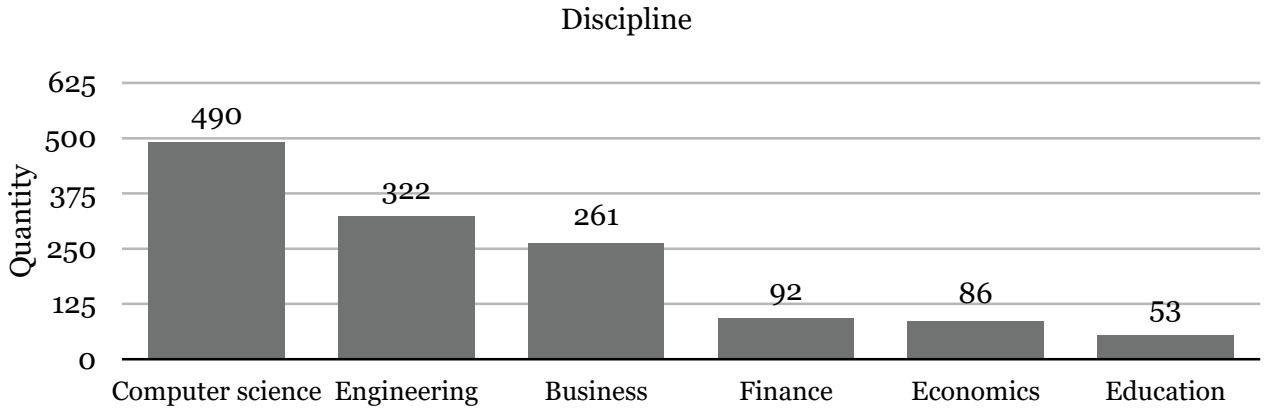


Fig. 2. Discipline distribution

Based on academic databases, one could conclude that there is only a small number of research papers related particularly to education – 53. However, there numerous papers related to both education and adjacent areas.

2. The Scholar Google databases contain information on researches from almost all the databases. It makes it possible to track the scientific community's interest towards a particular field. Once one has typed "Blockchain in education" or "Blockchain for education", one can track the dynamics of publications year-by-year up to 2019. Figure 3 presents annual (12-month-long) dynamics of publications.

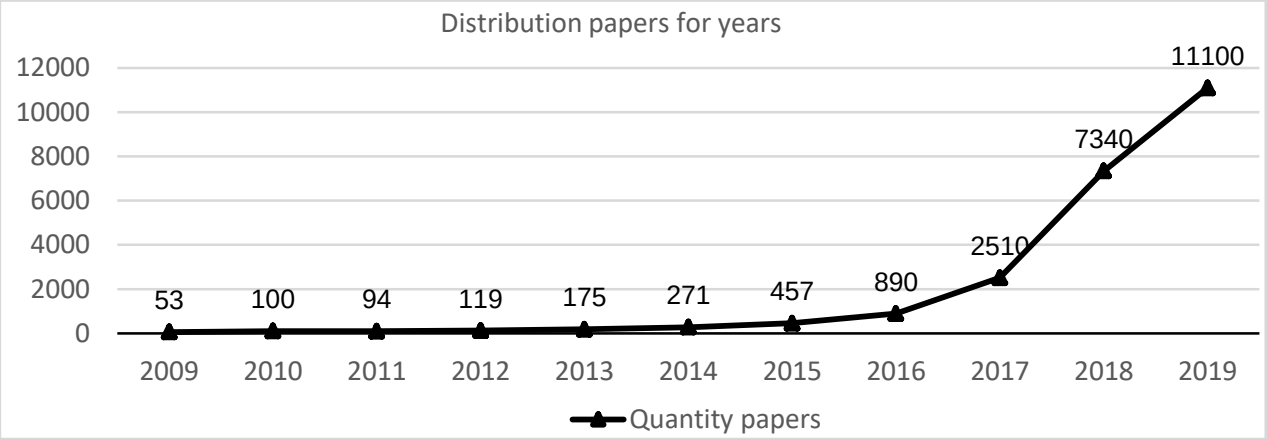


Fig. 3. Distribution of papers for time

Our research determines the following temporal limitations to analyze research literature: October 2008 – March 2020. The reason for these limitations is that the cornerstone paper by S. Nakamoto (Nakamoto, 2008) was published in October 2008. That paper stimulated further research in the field of blockchain. There has been a considerable growth in the number of research papers since 2015, when M. Swan (Swan, 2015) published her paper, in which she indicates that it is possible to apply blockchain not only in the field of finances, but also in such areas as public administration, healthcare, education, science, culture, and arts. Adoption of national artificial intelligence development and digital economy transformation strategies by developed countries contributed to a growing number of publications in 2017 (See Table 1). As for March 01, 2020, 48 countries adopted this strategy; thus, research related to digitalization of economy (in particular, in the field of education) became of top priority in those countries.

Table 1. National artificial intelligence development and digital economy transformation strategies

Year	Countries that adopted programs of national artificial intelligence development and digital economy transformation strategies	Number of Countries	Number of Countries (Cumulative)
2017	Canada, Japan, China, Singapore, United Arab Emirates	5	5
2018	Italy, South Korea, India, Pakistan, Kenya, Mexico, Sweden, United Kingdom, France, Ireland, Netherlands, Germany, New Zealand, South Africa	14	19
2019	Denmark, Qatar, Tunisia, United States of America, Australia, Estonia, Malta, Russia, Spain, Austria, Finland, Philippines, Saudi Arabia, Belgium, Colombia, Lithuania, Poland, Czech Republic, Luxembourg, Portugal	21	40
2020 (Jan-Feb)	Argentina, Norway, Chile, Switzerland, Brazil, Israel, Thailand, Vietnam	8	48

We have used several academic search engines to reveal that the largest number of publications concerning application of the blockchain technology in education is in Scholar Google (prior to 2020) – 18,440. Such a large amount is because this system includes research findings in all the world languages; it also comprises the most respectable search engines, such as Scopus, Science Direct, SpringerLink, JSTOR, SSRN, and arXiv. In these systems, our query “Blockchain in

education" has provided us with 1,641 sources, of which we have left only 48 for further consideration.

Of 134 GL sources, we have used only 4 in this paper.

This paper applies materials from 2008 to 2020. Figure 4 presents distribution of research of blockchain technologies by country.

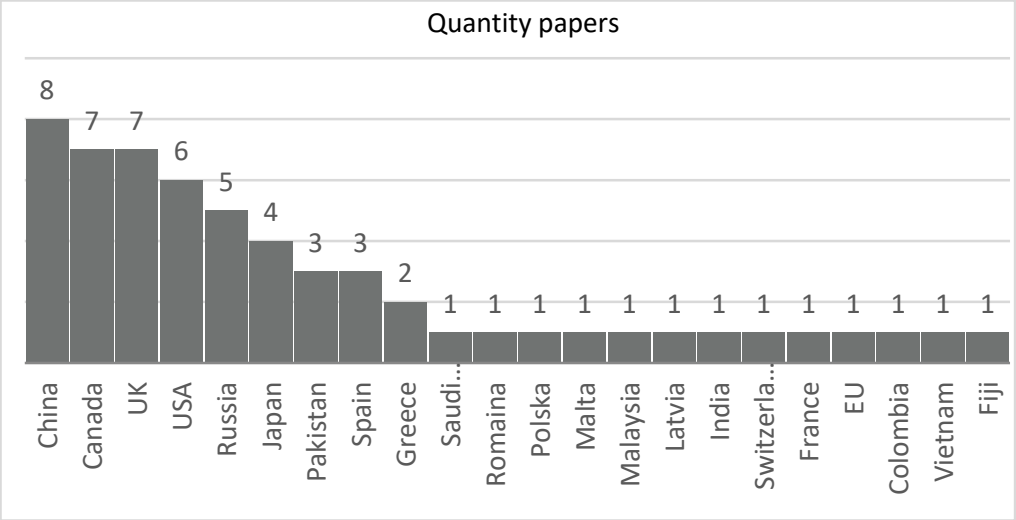


Fig. 4. Distribution of blockchain-in-education research by country

Thus, the largest number of publications concerning the blockchain technology in education relates to two countries: China and Canada. At the same time, papers from other countries are also valuable and have a high citation index: Malta, Latvia, Fiji, Vietnam, etc.

3. Results

This paper is based on research findings by the most cited authors. To analyze their citation indices, we have used two databases – Scholar Google and SpringerLink.

We have grouped our Systematic Literature Review into three research categories: (1) research papers that determined tendencies in the field of the blockchain technology development; (2) review papers related to the development of blockchain in higher education; (3) specialized papers related to the development of blockchain in higher education.

Findings of Analysis of Research Papers that Determined Tendencies in Blockchain Technology Development

Table 2 presents research papers by authors who developed the theory of blockchain; these papers are the base for specialized research in various fields, including higher education.

Table 2. The Most Cited Authors Who Determined Tendencies in the Field of Blockchain Technology Development

Author & Name of Article	Year	Number of Citations	Type of Research Paper	Country
Nakamoto, S. Bitcoin: A Peer-to-Peer Electronic Cash System	2008	10,277	Article	Japan
Swan, M. Blockchain: Blueprint for a New Economy	2015	2,504	Book	UK

Kosba, A.; Miller, A.; Shi, E.; Wen, Z.; Papamanthou, C. Hawk: The Blockchain Model of Cryptography and Privacy-Preserving Smart Contracts	2016	1,166	Conference Proceedings	USA
Buterin, V. A Next-Generation Smart Contract and Decentralized Application Platform	2014	1,078	Journal Article	Canada

Satoshi Nakamoto is the most cited and influential author. In 2008, he published his article "Bitcoin: A Peer-to-Peer Electronic Cash System" (Nakamoto, 2008), which described the technology of the new cash system, which he named bitcoin, in a strict academic style, with all the necessary schemes and formulas. He describes an electronic payment system based on cryptography, not on trust. The system works without an intermediary (banks) and resolves the issue of "double spending". The author suggested a new technology of decentralized digital cash turnover, which consists of two elements. First, it is the distributed registry (Blockchain), which S. Nakamoto developed; it is a chain of digital transactions in which each following block is linked with a preceding one by means of cryptography. Any correction of already submitted information related to transactions is impossible. It guarantees that all the transactions within the registry shall not be changed and that they shall be protected from theft or double spending. Secondly, S. Nakamoto presented a cryptographic algorithm of mining (obtainment) of bitcoins, which determined the mechanism of rewarding the network participants for their provision of sufficient resources (computer performance and electric power) to sustain the blockchain working capacity.

As several years have passed, the system suggested by S. Nakamoto has become of special value for programmers; it has been promoted and enhanced; however, no close attention was paid to research in this field.

In 2014, V. Buterin published his work "A Next-Generation Smart Contract and Decentralized Application Platform" (Buterin, 2014). Having presented advantages and restrictions of blockchain, he suggested the new Ethereum blockchain with an embedded programming language, which makes it possible for everyone to write smart contracts (Szabo, 1996) and decentralized applications, thanks to what the blockchain technology may be applied far beyond bitcoins. V. Buterin has developed three types of applications (1) financial applications that help users manage their assets and conclude contracts; (2) semi-financial applications that involve both money and nonmaterial assets; (3) nonfinancial applications, such as online voting and decentralized management. The new Ethereum blockchain is an open platform, which simplifies introduction of this technology significantly. It is also the reason for a profound interest towards it among both new startups and major developers of software and other businesses.

Implementation of this new blockchain stimulated further research and development in this field. A real problem and a crucial requirement towards its platforms was provision of data confidentiality. In 2015, the work "Hawk: The Blockchain Model of Cryptography and Privacy-Preserving Smart Contracts" by A. Kosba, A. Miller, E. Shi, Z. Wen, and C. Papamanthou (Kosba et al., 2015) suggested a solution to this problem. The main idea, which laid the foundation of the Hawk confidential smart contracts, implied application of a common software compiler to encode a smart contract with a cryptographic protocol. The Hawk software consists of (1) a private portion, where transaction data and other personal data are protected with cryptographic methods from the external environment, and (2) the public portion, which does not concern private data or money. From the viewpoint of security, "on-chain privacy protects contractual parties' privacy against the public (i.e., parties not involved in the financial contract), contractual security protects parties in the same contractual agreement from each other", since the parties may desire to infringe the contract.

Therefore, the development of Hawk as a system of intellectual contracts has made it possible to apply the blockchain technology in various fields.

In her paper "Blockchain: Blueprint for a New Economy", M. Swan (Swan, 2015) considers blockchain as a new organizational paradigm to coordinate any sort of human activities. She identifies the following stages of the technological blockchain revolution: Blockchain 1.0, 2.0., and 3.0. Blockchain 1.0 was created and applied for cryptocurrencies; its goal was to make common

cash transactions easier. As for Blockchain 2.0, it was created for property bargains by applying the algorithm of smart contracts. In Blockchain 3.0, many applications were developed for such sectors as government, education, healthcare, and science. Nowadays Blockchain 4.0 is applied; it implies development of large-scale industrial applications on its base; those applications would be able to control numerous processes simultaneously, processing and storing huge data arrays, making those data logically correlated. Blockchain 5.0 is able to formalize over 80 % of events taking place in a human life, from logistics and sale/purchase of goods to copyright (Filatov, 2020). M. Sawn assumes that blockchain will develop from the idea of decentralized applications to the idea of decentralized autonomous organizations and corporations that operate without humans but comply with a set of business rules and regulations.

The number of research papers concerning blockchain in education is still relatively small; the number of citations per paper does not exceed 100, according to SpringerLink.

Let us divide the blockchain-related literature that we have analyzed into reviews and specialized research, with the latter referring to application of blockchain in a particular sphere of the educational process.

Findings of Analysis of Review Papers

As a rule, review papers are based on secondary data, whereas specialized ones are based on primary data. Blockchain is a rapidly growing field of research; our search for review papers that analyze its development trends has led us to only seven papers (See Table 3).

Table 3. Review papers related to application of blockchain in education

Author & Name of Article	Year	Number of Citations	Type of Research Paper	Country
Grech, A. and Camilleri, A. F. Blockchain in Education	2017	180	Report	EU
Chen, G., Xu, B., Lu, M. et al. Exploring Blockchain Technology and Its Potential Applications For Education	2018	53	Journal Article	China
Yumna H., Murad Khan M., Ikram M., Noreen S. and Sabeen R. Use of Blockchain in Education: A Systematic Literature Review	2019	7	Conference Proceedings	Pakistan
Kamišalić A., Turkanović M., Mrdović S., Heričko M. A Preliminary Review of Blockchain-Based Solutions in Higher Education	2019	4	Conference Proceedings	Slovenia
Alammary, A.; Alhazmi, S.; Almasri, M.; Gillani, S. Blockchain-Based Applications in Education: a Systematic Review	2019	10	Journal Article	Saudi Arabia
Hameed B., Murad Khan M., Noman A. et al. A Review of Blockchain Based Educational Projects	2019	1	Journal Article	Pakistan

The first review of application of blockchain in education is the work by A. Grech and A. Camilleri “Blockchain in Education” (Grech, Camilleri, 2017). This work is one of the five Highly Influenced Papers related to Blockchain in Education, according to Semantic Scholar (64 citations) and Scholar Google (181 citations). It is a report by the Joint Research Centre (JRC), the European Commission’s science and knowledge service, which describes real cases of application of

blockchain at universities. Application of the blockchain technology in higher education started in 2014, when the University of Nicosia, Cyprus (UNIC) commenced to apply this technology on an official basis to store and confirm its diplomas; it was also the first university that began to accept fees for studies as bitcoins (UNIC, 2014). Since 2017, the UNIC has been publishing all its graduates' diploma projects (bachelors, masters, and PhDs) in blockchain by applying its own development – the block.co blockchain platform (UNIC, 2014). This platform is used by both educational institutions and healthcare facilities, the public sector, transport, etc. In 2016, the Sony Global Education supported by IBM developed a blockchain platform to store, protect, and exchange information related to students' performance and progress. The company regards blockchain as the main technology that can influence the educational landscape in the future (Sony Global Education, 2016). The Massachusetts Institute of Technology (MIT) developed its blockchain-based Blockcerts in 2017; this application makes it easier to issue digital diplomas and professional certificates (Durant, 2017).

The work by A. Grech and A. Camilleri applies qualitative methods of research, such as interviews with experts and a literature review. The two authors propose eight scenarios to apply blockchain in education: (1) for permanent protection of certificates; (2) to verify the multi-stage accreditation; (3) for automatic recognition and transaction of credits; (4) as a lifelong training passport; (5) to track intellectual property and its rational application; (6) to receive payments from students via the blockchain; (7) to provide financing of students (issue vouchers to them) via blockchain; (8) to identify students (Grech, Camilleri, 2017).

The suggested development scenarios of blockchain in education (except for (7)) are mid-term and short-term ones. This research pays hardly any attention to long-term scenarios. Unresolved issues, which hamper application of blockchain, according to the two authors, are as follows: difficulties with data verification in the third-world countries, which have no centralized data management, and absence of a global system of standards. Of the six peculiar features of blockchain, the authors consider only three. Probably, it is because all the projects realized in this field were only at their pilot stage when this paper was written.

All the reviews that we have analyzed are based on the following classification of research papers, which considers with the specifics of the blockchain technology:

1. Decentralized processes of information storage and processing. Each network participant stores all the recorded information. It makes it possible to create geographically distributed networks, centralized databases, and backup (Yumna et al., 2019; Hameed et al., 2019).

2. Unchangeable data. Blockchain allows verification of the entire information sequence at any time (Hameed et al., 2019; Koyfmann, Tabernakulov, 2019; Yumna et al., 2019; Chen et al., 2018).

3. Tracking of transactions. The entire contents of transactions is readable for any network participant, but access to change other participants' records is impossible without a special key (Chen et al., 2018; Hameed et al., 2019; Yumna et al., 2019).

4. Mechanism of consensus: the participants maintain the network themselves. It implies mutual maintenance of all the nodes of the blockchain network. It helps resolve such issues as risk of manipulation with data; it does not require a third party's interference (Grech, Camilleri, 2017; Hameed et al., 2019; Yumna et al., 2019).

5. Cryptocurrency. It is applied to resolve issues related to proving execution of commitments, e.g., a reward may be issued as a cryptocurrency via a smart contact (Chen et al., 2018; Yumna et al., 2019; Hameed et al., 2019).

6. A smart contract works with the parties' direct participation. It is a self-controlled working program, which is transmitted via the nodes of a chain of blocks. It is a proof of execution of commitments in the real-time mode; it contributes to reduction of losses related to commissions and internal audit (Sharples, Domingue, 2016; Chen et al., 2018; Yumna et al., 2019).

Based on specific features of blockchain, its advantages and drawbacks, G. Chen (Chen et al., 2018) identified four trends of its application in the educational process: (1) identification of parties involved in the process of education; (2) digital encoding of the parties' rights and commitments; (3) performance assessment of a student; (4) education as a source of income.

The paper by A. Kamišalić, M. Turkanović, S. Mrdović, and M. Heričko (Kamišalić et al., 2019) identifies four fields of blockchain application that include 17 projects: 8 of them relate to

records storage and application; 2 projects are identified as efficient games; 3 projects are defined as digital market assets; 4 projects regard blockchain as a destroyer of traditional education.

The first field related to records storage and application includes: (1) a verifiable credential for completion of a digital currency course; (2) an open standard for applications that provide blockchain-based certificates; (3) control and provision of any type of digital microcredits; (4) blockchain-based verification of diplomas; (5) protection of copyright; (6) registration of intellectual property; (7) copyright registration service applied for images; (8) copyright for artists' intellectual property.

The second field relates to application of blockchain in education as a digital market asset: (1) charging fees in bitcoins; (2) an educational platform for cryptocurrency rates; (3) an educational portal contributing to exchange of knowledge.

The third field regards blockchain as an efficient educational game (gamification). Creation of educational online platforms that imply game experience in education: (1) verification of students' diplomas; (2) formation of a lifelong academic passport.

The fourth field, which regards blockchain as a destroyer of traditional education, includes the following projects: (1) educational platforms implying game experience in education and cryptocurrency-based scholarships; (2) digital platforms to record all what was studied; (3) platforms uniting students and their professors; (4) open publishing platforms that sustain the reviewing process.

One could remark that this classification has a drawback, since many projects mentioned by these authors might be referred to several fields.

The authors of the work "Use of Blockchain in Education" (Yumna et al., 2019) have selected another way to classify fields of research. They classify blockchain projects based on issues that this technology resolves. They identify three aspects of those issues.

The physical aspect comprises problems that are due to physical processing of documents and human actions: risk of manipulation with records when humans create them; difficulties in verification of records; single point failure (Grech, Camilleri, 2017).

The digital aspect includes issues related to documents that are stored electronically in the Internet: risk of forging digital records; risk of losing digital documents and their discredit; the problem of records exchange between institutions (Grech, Camilleri, 2017).

The financial aspect concerns issues related to management of money: transaction commissions; difficulties in verification of proofs of commitments execution (Chen et al., 2018), (Rooksby, Dimitrov, 2017).

We have analyzed reviews of research papers related to blockchain in education considering with problems related to application of the blockchain technology (Yumna et al., 2019). Let us supplement our analysis with the legal aspect, which relates to legal support of blockchain projects.

Table 4. Comparative table of blockchain-related reviews

Research	Existing problems in education				Features of blockchain	Problems with blockchain implementation
	Physical	Digital	Financial	Legal		
A. Grech, 2017	+	+	-	+	+	+
G. Chen, 2018	+	+	-	-	+	+
A. Kamišalić, 2019	+	+	+	-	+	-
H. Yumna, 2019	+	+	+	-	+	+
A. Alammary, 2019	+	+	-	-	+	+
B. Hameed, 2019	+	+	-	-	+	+
Our research	+	+	+	+	+	+

The analysis of reviews presented in this article (See Table 4) proves that many reviews are of fragmentary character; they do not describe all the aspects of blockchain application in education, since this is still a new field of research. Our research is different from previous reviews; it concerns a broader range of issues in education, which may be resolved by applying the blockchain technology; it also considers research findings over a longer period – from 2009 to 2019. This

research takes into account works written in Russian and analyzes specifics of blockchain application in Russia.

Findings of Analysis of Specialized Papers

Based on our analysis of specialized papers, let us propose a new classification of fields of blockchain application in education (See Table 5). This classification is based on specifics of blockchain, as well as on the problems that this technology resolves.

Table 5. Fields of blockchain application in education

Fields	Projects	Research Papers	Problems Resolved by Blockchain
Issue and storage of certificates and diplomas	Blockcerts; BCDiploma; UNIC Blockchain Certification Programs	(Sharples, Domingue, 2016; Grech, Camilleri, 2017; Chen et al., 2018; Budhiraja, Rani, 2020; Curmi, Inguanez, 2019; Bandara, 2018)	Physical, digital, legal
Identification solutions	Civic	(Grech, Camilleri, 2017; Mikheenko, 2018; Kirilova et al., 2018)	Physical, digital
Protection of intellectual property	Binded	(Guo et al., 2020)	Physical, digital, legal
New network of cooperation between students and their professors	ConsenSys	(Tapscott, Tapscott, 2017; Castañeda, Selwyn, 2018; Tapscott, Kaplan, 2019)	Physical, digital
Formation of an academic passport (portfolio)	TUDocChain BLOCK.CO	(Budhiraja, Rani, 2020; Klimonov, Popova, 2020)	Digital
Payment for studies with a cryptocurrency	TEduChain BitDegree	(Devine, 2015; Rooksby, Dimitrov, 2017; Rashidet et al., 2019; Zhou et al., 2020);	Financial, legal
Accreditation of educational institutions	QualiChain	(Kirilova, 2018; (Kontzinos et al., 2019).	Digital, legal
Administration of the educational process	QualiChain EduCTX	(SharplesDomingue, 2016; Kirilova, 2018; Turkanović et al., 2019)	Physical, digital, legal

1. Issue and storage of certificates and diplomas

This is the most widely spread field in which the blockchain technology is applied in education. A majority of article included in this review take into account applications to control the process of issue and storage of electronic certificates and diplomas. Nowadays ecosystems of digital certifications BADGR and Mozilla Open Badge (Grech, Camilleri, 2017) are applied in European

countries. The University of Nicosia (Sharples, Domingue, 2016; Chen et al., 2018) and the Massachusetts Institute of Technology (MIT Media Lab, 2020) were the first to develop and implement this standard to start issuing and verifying digital certificates. This is the MIT web site to verify certificates, which allows an independent data checkup: credentials.mit.edu. In 2016, the Sony Global Education announced that it had developed a technology to store academic records (Sony Global Education, 2016). In 2017, the Malta College of Arts, Science & Technology began to issue Blockcerts-based digital certificates (Chen et al., 2018). The same year, Chinese researchers developed the ECBC blockchain to control certificates of education. It has a higher performance rate than the previous standard (Xu et al., 2017). The number of blockchains to issue diplomas and certificates grows every year (Bandara, 2018; Curmi, Inguanez, 2019; Budhiraja, Rani, 2020). Some researchers assume that blockchain undermines the role of traditional formal educational institutions, since it is an alternative supplier of diplomas and certificates (Nespor, 2019).

2. Identification solutions

Students and faculty of large universities need to identify themselves on a regular basis while dealing with various units of their universities. In those cases, each unit of an institution collects students' data for itself or applies the single-sign-on technology, thanks to what a single copy of a student's data is applied by all the parties within that institution. Consequently, many people can access a student's personal data. To ensure security of those data, access rights of all those people require control; the data must be secured and protected from hacking. Once a student has submitted his/her data to the university admission commission, he/she is granted their ID as a key in return. Applying biometric information (Mikheenko, 2018; Kirilova et al., 2018) on any electronic device (e.g. a smartphone), a student may identify himself/herself with any university unit, e.g. the local library or canteen; those units do not need to store or look through that student's personal data (Grech, Camilleri, 2017). The following blockchain-based solution is proposed: the Uport system for independent self-identification (this Ethereum-based system has been developed by applying ConseSys). This technology consists of three components: a smart contract, libraries for developers, and a mobile application. However, citizens of 45 countries (including Russia) are prohibited to apply this system.

3. Protection of intellectual property

Nowadays blockchain is widely applied in the field of intellectual property. Applying this technology, one can record the fact and the moment of creation of an object of intellectual property. The Binded platform is one of the projects that provide such opportunities. The structure of objects of intellectual property law is changing now. More and more frequently, those are digital records, not physical objects. The blockchain technology has no alternatives when it comes to intellectual property rights for digital records. For instance, extraction of data from a distributed registry for digital objects may be the only source of proofs that a particular individual has legal rights for those objects. In particular, it may relate to objects of programming, which emerge every day (Guo et al., 2020).

4. Network of cooperation between students and their professors – new pedagogics

A majority of universities apply the technologically extended classroom-teaching model. New technologies change this approach. Lifelong education is becoming accessible, personalized, and methodologically urgent. "Blockchains provide a platform for students in collaboration, not just tracking people's individual contributions but also rewarding them for results" (Tapscott, Kaplan, 2019).

"A good model for classroom collaboration is Consensus Systems (ConsenSys), one of the first Ethereum software-development companies" (Tapscott, Kaplan, 2019). This development is based on new principles – those are "dynamic roles rather than traditional job descriptions; distributed, not delegated authority; transparent rules rather than office politics; and rapid reiterations rather than big reorganizations" (Tapscott, Tapscott, 2017).

One of the problems of individualized education is a vague conventional characteristic of education as a public benefit, since new technologies cause considerable differences from the viewpoint of social diversity, commitments, solidarity, and social relations (Castañeda, Selwyn, 2018).

5. Formation of an academic passport (portfolio)

Blockchain is applied to ensure security of information storage in an electronic portfolio, which may be formed throughout one's entre life and contain complete, trustworthy, and unchangeable information concerning the holder of that portfolio. The blockchain-based portfolio formation concept (Klimonov, Popova, 2020; Vakurin et al., 2018) suggests two types of users – a student and an administrator. A student applies a web application to upload his/her achievements to the database by completing the appropriate fields and attaching the necessary documents. The administrator verifies those data. Should the data be confirmed, it is submitted to the blockchain. However, if that blockchain is private, portfolio formation options depend on the capacity of the educational institution where a student studies. As for public blockchains, they ensure one's rights for authorizing academic certificates in a public book in a reliable and sustainable format (Budhiraja, Rani, 2020). At the same time, it is necessary to standardize formats of electronic documents to provide their automatic verification. In Russia, it is more difficult to resolve this issue, since application of public blockchains is actually blocked in this country (Khalizev et al., 2018).

6. Payment for studies with a cryptocurrency

The work "Blockchain Learning: Can Crypto-Currency Methods Be Appropriated to Enhance Online Learning?" (Devine, 2015) was the first to suggest application of a cryptocurrency to pay for studies, so as to provide broader opportunities for students participating in exchange programs. This idea was developed in the work "Trustless Education? A Blockchain System for University Grades" (Rooksby, Dimitrov, 2017). Nowadays benefits for students and universities from circulation of tokens, e.g. to purchase university souvenirs, pay for academic courses, avoid commission when paying for education are under consideration (Zhou et al., 2020).

The work "TEduChain: A Platform for Crowdsourcing Tertiary Education Fund using Blockchain Technology" (Rashid et al., 2019) presents a broader view on opportunities of cryptocurrency application in education. The TEduChain is regarded as a platform to create and store agreements between students and sponsors of higher education. Sponsorship is possible in any form: scholarships, donations, or loans.

With the TEduChain undergoing the development stage now, BitDegree has already realized the idea when sponsors select students to support with funding. The sponsors' money is converted into BDG tokens (in correlation 1:1) and stored in a smart contract until a sponsored student has completed his/her studies successfully. "The Blockchain "pay for success" scheme could enable private companies support the development of skills they are interested, by financing individual students" (Capetillo, 2018).

7. Accreditation of educational institutions

Application of blockchain to verify accreditation is under consideration in the work "Prospects of Implementation of Blockchain Technology in the Modern System of Education" (Kirilova, 2018). Accredited organizations can create and publish "verifiers" on their own web sites, which will allow any user to upload their diploma and verify whether it was indeed issued by an accredited institution, as well as publish issued diplomas in a public registry. It would allow any third party to check: (1) a diploma that a university issued to a student; (2) whether that university has an accreditation in a public registry; (3) whether the above-mentioned information is true. To implement this technology, an independent trusted party should create a public registry.

Thanks to the QualiChain project, "school's secretariat will avoid time-consuming processes for degree verification and other administrative issues, given that the pertinent documents will exist in QualiChain, secure and already verified" (Kontzinos et al., 2019).

8. Administration of the educational process

The QualiChain project concerns not only accreditation of students and educational institutions; it also has a potential for a larger-scale optimization of the educational process at universities, suggesting an efficient design of educational programs.

Obvious application of the blockchain technology in education is storage of performance and credit records (Sharples, Domingue, 2016; Zaslavsky 2018). Nowadays this technology is applied much more widely than before. In particular, the EduCTX platform is based on the concept of the European Credit Transfer and Accumulation System (ECTS) (Turkanović et al., 2019). This platform is used to process and control ECTX tokens as academic credits. Students and

organizations (e.g. companies as potential employers) are users of this platform. The EduCTX platform is integrated with the existing information systems of universities in various countries (Turkanović et al., 2019).

Based on the conducted analysis of reviews, specialized research papers, and university web sites, this article proposes a summarizing table of cases of application of blockchain in higher education.

Table 6. Review of fields of blockchain application by various universities

Country	University	Fields of Blockchain Application
Cyprus	University of Nicosia	Issue and storage of certificates and diplomas. Payment for studies with a cryptocurrency.
USA	Massachusetts Institute of Technology (MIT)	Issue and storage of certificates and diplomas. Identification solutions.
	Holberton School of Software Engineering	Issue and storage of certificates and diplomas. Identification solutions.
	University of Texas at Austin	Issue and storage of certificates and diplomas. Network of cooperation between students and their professors – new pedagogics.
	University of New Hampshire	Issue and storage of certificates and diplomas.
	King's College	Payment for studies with a cryptocurrency.
	University of California	Issue and storage of certificates and diplomas.
Great Britain	Open University	Issue and storage of certificates and diplomas. Network of cooperation between students and their professors – new pedagogics. Accreditation of educational institutions.
	University of Southampton	Issue and storage of certificates and diplomas. Network of cooperation between students and their professors – new pedagogics.
	Woolf of University	The first blockchain university. Issue and storage of certificates and diplomas. Identification solutions. Payment for studies with a cryptocurrency. Administration of the educational process.
Malta	Malta College of Arts Science and Technology	Issue and storage of certificates and diplomas.
Slovenia	University of Maribor	Issue and storage of certificates and diplomas. Administration of the educational process.

Greece	Aristotle University of Thessaloniki, Athens University of Economics and Business, Democritus University of Thrace	Issue and storage of certificates and diplomas. Identification solutions.
UAE	Universities in Dubai	Issue and storage of certificates and diplomas. Formation of an academic passport (portfolio).
Bahrein	University of Bahrein	Issue and storage of certificates and diplomas.
Australia	University of Melbourne	Issue and storage of certificates and diplomas.
Mexico	Central New Mexico Community College	Issue and storage of certificates and diplomas.
Singapore	Ngee Ann Polytechnic	Issue and storage of certificates and diplomas.
China	Zhejiang University, Shenzhen University, Chinese Academy of Sciences	Protection of intellectual property.
Canada	20 % of all universities in Canada	Issue and storage of certificates and diplomas.
Russia	Synergy University	Since 2020. Issue and storage of certificates and diplomas. Network of cooperation between students and their professors – new pedagogics.
	Penza State University	Since 2020. Issue and storage of certificates and diplomas.

Thus, we have identified and classified the main fields of reviews and specialized research related to application of the blockchain technology in higher education; this paper presents the countries and the universities that implement this technology as a single table.

To implement and apply this innovative technology in education efficiently, it is necessary that the society was aware of this technology and was prepared to apply it. We regard the academic community as a vanguard of innovative economy, so our survey has been conducted to determine how well representatives of this community are informed of opportunities to apply the blockchain technology in higher education.

112 representatives of 12 Russian higher educational institutions have participated in our survey: Astrakhan State University; Baikal State University; Buryat State University; Volgograd State University; the Volzhsky Institute of Economics, Pedagogy and Law; Far Eastern Federal University; the Gubkin Russian State University of Oil and Gas; Kazan Federal University; Moscow State University; the Moscow State Institute of International Relations (MGIMO); Saint Petersburg State University; Sochi State University.

The respondents' minimal age is 36. Their maximal age is 68. The average age of the respondents is 47.9.

Since we were interested in measuring the respondents' awareness/unawareness of the blockchain technology, we applied inferential statistics to reveal the percentage of those who are aware of it.

We checked the hypothesis that over 50 % of faculty staff of Russian university are unaware of the blockchain technology and opportunities of its application in higher education.

The hypotheses are represented as follows:

The null hypothesis: $p \leq 0.5$

The alternative hypothesis: p > 0.5

Let us determine the significance level at 0.05.

Let us calculate the standard error by applying the formula: $\sigma_p = \sqrt{p(1-p)/n}$, where p is the value assumed by the null hypothesis.

After that, let us calculate the observed z-score: $\frac{p_1 - p}{\sigma_p}$, where p_1 is the observed survey value. Let us compare it with the critical z-score. Should the observed z-score be higher that the critical z-score, let us reject the null hypothesis. Otherwise, we shall not reject it. Applying the observed z-score, let us determine the p-value.

Table 7 presents the obtained results.

Table 7. Responses to the question "Do you know about the blockchain technology?"

"Do you know about the blockchain technology?"	Number of responses	Percentage of responses	Observed Z	P-value
Yes	64	57.1	1.501	0.0668
No	48	42.9		

With the significance level equal to 0.05, the critical value of z is equal to 1.645. Since the observed value is smaller than the critical one, we do not reject the null hypothesis and conclude that over 50 % of Russian university professors are unaware of the blockchain technology.

Of those respondents who are aware of this technology, let us determine the percentage of those who are aware of application of this technology in education (See Table 8).

Table 8. Responses to the question "Do you know about application of the blockchain technology in education?"

"Do you know about application of the blockchain technology in education?"	Number of responses	Percentage of responses	Observed Z	P-value
Yes	40	62.5 %	2	0.0228
No	24	37.5 %		

With the significance level equal to 0.05, the critical value of z is equal to 1.645. Since the observed value is equal to 2, it is exceeds the critical one; so let us reject the null hypothesis and conclude that over 50 % of Russian university professors are aware of the blockchain technology, as well as its application in education.

Table 9 presents the results of asking the respondents the question related to application of blockchain in education.

Table 9. Responses to the question related to application of blockchain in education

"What opportunities of application of blockchain in education do you know?"	Percentage of responses
Issue and storage of certificates and diplomas	22.2 %
Identification solutions	16.7 %

Protection of intellectual property	11.1 %
Network of cooperation between students and their professors – new pedagogics	5.6 %
Formation of an academic passport (portfolio)	11.1 %
Payment for studies with a cryptocurrency	16.7 %
Accreditation of educational institutions	5.6 %
Administration of the educational process	11.1 %

Based on responses to this question, one can conclude that a majority of professors believe that the blockchain technology may be applied in three fields: 1) issue and storage of certificates and diplomas; 2) identification solutions; 3) payment for studies with a cryptocurrency.

As for the question related to application of this technology in their educational institutions, representatives of the abovementioned federal universities and Moscow-based universities have responded positively; the rest of the respondents have indicated that they do not know.

Based on the conducted survey of representatives of the Russian academic community, let us conclude that implementation of this technology in education is at its initial stage. The academic community is still insufficiently informed of this technology and its application in education; it does not have many ideas in which particular fields it may be applied.

4. Discussion

We have limited our Systematic Literature Review by grouping research papers as follows: research literature that determined tendencies in the field of the blockchain technology development; review papers concerning the development of blockchain in higher education; specialized papers concerning the development of blockchain in higher education.

The results of our research prove that blockchain management is a complicated task both from the viewpoint of the general ecosystem and at the platform level. Development of the appropriate policy and its regulation face obstacles, since the blockchain networks operate at the international level and are not attached to only one jurisdiction. Implementation of updates or changes for a general-access block network is a problem of control at the platform level caused by decentralized decision-making that involves many participants. In its turn, centralized implementation of updates may result in security threats.

Russian researchers (Shamsutdinova, 2018) determine a more complicated problem of implementing blockchain in the system of higher education, emphasizing the technological and organizational aspects. As a key problem, they mention absence of a national blockchain platform, absence of a centralized controlling structure that would coordinate the “educational” blockchain as a single digital information space. However, this idea and this attempt to regulate it contradicts the idea and the main advantage of blockchain as a decentralized system. Here one should note that much fewer blockchain projects have been realized in the public sector than in the private sector.

A larger-scale application of the blockchain technology may be hampered with the following factors:

1. The information factor. A majority of representatives of the academic community, as our survey has revealed, are unaware of this technology.

2. The technological factor. Only 86 % of Russian organizations have a broadband access to the Internet, whereas this rate in the EU countries is nearly 100 % (Abdrakhmanova, Kovaleva, 2019). This fact may become critical owing to external challenges that the educational system currently faces, as well as owing to a high competition in this sphere. In the future, it is possible that competition will be taking place between blockchain platforms, not between universities.

3. The legislation factor. In many countries, using blockchain for applications or a cryptocurrency has a vague legal status. In Russia, despite the decision made by the Ministry of Science and Higher Education of the Russian Federation concerning rejection of paper diplomas of higher education and their conversion into the electronic format in 2020, the legal status of such

diplomas has not still been stipulated officially. It is also planned to prohibit emission and circulation of cryptocurrency since 2020.

4. The organizational factor. The development of this technology reduces expenses for the university administrative staff, so university administrations may resist implementation of this technology.

5. Conclusion

The conducted analysis of projects and researches related to the blockchain technology in higher education makes it possible to conclude that this new technology is gaining popularity and conquering the educational space. Its implementation changes the concept of interaction between students and their professors, which makes education more accessible and personalized. An individual's personal strategy aimed at lifelong education is becoming an objective necessity now; the blockchain technology provides resources necessary for its realization. At the same time, the blockchain technology may result in unequal opportunities in obtaining online and offline education. One should note that a majority of universities, which have developed educational blockchain technologies, are still using those technologies as a supplement to traditional forms of education.

In Russia, educational blockchain technologies are at the stage of research and implementation of some elements. Pilot projects are expected to start in 2020. Of the application fields described above, two fields will be implemented: issue and storage of certificates and diplomas; personality identification solutions.

The number of researches of the blockchain technology is growing at a significant pace. Quite frequently, technological developments and solutions in this field become a base and a stimulus for academic research. One can state that if several years ago researches suggested some particular fields of applying blockchain in education, nowadays there is a tendency to accumulate the entire range of university functions in blockchain projects: administration of the educational process; storage of information related to degrees, scholarships, etc.; creation and maintenance of students' and graduates' portfolios; a large-scale application of operations with cryptocurrency (up to investment projects); realization of opportunities that the new pedagogics provides.

The most important advantages of educational blockchain technologies are formation of a single educational environment, creation of network communities, exchange with technologies and scientific knowledge, and copyright protection of the network participants.

6. Acknowledgements

The reported study was funded by RFBR, project number (project No. 19-110-50332 "Application of Blockchain Technology in Higher Education").

References

Abdrakhmanova, Kovaleva, 2019 – *Abdrakhmanova, G., Kovaleva, G.* (2019). Tsifrovizatsiya biznesa v Rossii i za rubezhom [Digitalization of Business in Russia & Abroad]. [Electronic resource]. URL: https://issek.hse.ru/news/309213798.html [in Russian]

Bandara, 2018 – *Bandara, I., Ioras, F., Arraiza, M.* (2018). The emerging trend of blockchain for validating degree apprenticeship certification in cyber security education. *INTED 2018 Proceedings*: 7677-7683. DOI: https://doi.org/10.21125/inted.2018.1828

Budhiraja, Rani, 2020 – *Budhiraja, S., Rani, R.* (2020). TUDoc Chain-Securing Academic Certificate Digitally on Blockchain. In: Smys S., Bestak R., Rocha Á. (eds). *Inventive Computation Technologies. ICICIT. Lecture Notes in Networks and Systems*. Vol. 98: 150-160. DOI: 10.1007/978-3-030-33846-6_17

Buterin, 2014 – *Buterin, V.* (2014). A Next-Generation Smart Contract and Decentralized Application Platform. [Electronic resource]. URL: https://cryptorating.eu/whitepapers/Ethereum/Ethereum_white_paper.pdf

Capetillo, 2018 – *Capetillo, A.* (2018). Blockchained education: Challenging the long-standing model of academic institutions. [Electronic resource]. URL: http://www.iacee.org/docs/P10-Blockchained_education_Challenging_the_long-standing_model_of_academic_institutions._52.pdf

Castañeda, Selwyn, 2018 – *Castañeda, L., Selwyn, N.* (2018). More than tools? Making sense of the ongoing digitizations of higher education. *International Journal of Educational Technology in Higher Education*. 15(22). DOI: 10.1186/s41239-018-0109-y

Chen et al., 2018 – *Chen, G., Xu, B., Lu, M., Chen, N.-S.* (2018). Exploring Blockchain technology and its potential applications for education. *Smart Learning Environments*. Vol. 5. Article number 1. [Electronic resource]. URL: https://link.springer.com/article/10.1186/s40561-017-0050-x

Curmi, Inguanez, 2019 – *Curmi, A., Inguanez, F.* (2019). BlockChain Based Certificate Verification Platform. In: Abramowicz W., Paschke A. *Business Information Systems Workshop*s. BIS 2018. Lecture Notes in Business Information Processing, vol. 339: 211-216. [Electronic resource]. URL: https://frankieinguanez.files.wordpress.com/2018/10/curmi_axel.pdf

Devine, 2015 – *Devine, P.* (2015). Blockchain learning: can crypto-currency methods be appropriated to enhance online learning? *ALT Online Winter Conference*: 7-10. [Electronic resource]. URL: https://oro.open.ac.uk/44966/8/Devine2015-altc-blockchainlearning-transcript.pdf

Durant, 2017 – *Durant, E.* (2017). Digital Diploma debuts at MIT. Using Bitcoin's blockchain technology, the Institute has become one of the first universities to issue recipient-owned virtual credentials. [Electronic resource]. URL: http://news.mit.edu/2017/mit-debuts-secure-digital-diploma-using-bitcoin-blockchain-technology-1017

Filatov, 2020 – *Filatov, A.* (2020). Blockchain evolution. Relictum Pro: blockchain 5.0. [Electronic resource]. URL: https://medium.com/@Highwayman1991/blockchain-evolution-relictum-pro-blockchain-5-0-320917ea4ae0

Grech, Camilleri, 2017 – *Grech, A. Camilleri, A.F.* (2017). Blockchain in Education. *Joint Research Centre (JRC)*: 134. DOI: 10.2760/60649

Guo et al., 2020 – *Guo, J., Li, C., Zhang, G., Sun, Y., Bie, R.* (2020). Blockchain-enabled digital rights management for multimedia resources of online education. *Multimed Tools Appl.* 79: 9735-9755. DOI: https://doi.org/10.1007/s11042-019-08059-1

Hameed et al., 2019 – *Hameed, B., Murad Khan, M., Noman, A. et al.* (2019). A review of blockchain based educational projects. *International Journal of Advanced Computer Science and Applications (IJACSA)*. 10(10): 491-499. DOI: 10.14569/IJACSA.2019.0101065

Kamišalić et al., 2019 – *Kamišalić, A., Turkanović, M., Mrdović, S., Heričko, M.* (2019). A Preliminary Review of Blockchain-Based Solutions in Higher Education. In: Uden L., Liberona D., Sanchez G., Rodríguez-González S. (eds) Learning Technology for Education Challenges. *Communications in Computer and Information Science*. Vol. 1011. Springer: 114-124. DOI: 10.1007/978-3-030-20798-4_11

Khalizev et al., 2018 – *Khalizev, V., Tarasov, E., Bachmanov, D., Yankevich, A.* (2018). Razrabotka modeli programmno-apparatnogo sredstva ob"ektivnoy attestatsii i vedeniya portfolio uchashchihsya i ispol'zovaniyam blokcheyn-tekhnologii [Development of Model of Hardware & Software Tool for Objective Certification and Keeping of Students' Portfolios by Applying the Blockchain Technology]. *Nauchnye trudy KubGTU*. 3: 428-435. [Electronic resource]. URL: https://elibrary.ru/item.asp?id=34993005 [in Russian]

Kirilova et al., 2018 – *Kirilova, D., Maslov, N., Astakhova, T.* (2018). Prospects for the introduction of blockchain technology into a modern system of education. *International Journal of Open Information, Technologies*. 6(8): 31-36.

Klimonov, Popova, 2020 – *Klimonov, M., Popova, V.* (2020). Informatsionnaya sistema elektronnogo portfolio studentov na osnove tekhnologii blokcheyn [Blockchain-Based Information System of Students' Electronic Portfolio]. [Electronic resource]. URL: https://drive.google.com/file/d/1T9_be9MqN9dvbd5CUsWH69TY-gCwZAGp/view [in Russian]

Kontzinos et al., 2019 – *Kontzinos, C., Markaki, O., Kokkinakos, P., Karakolis, V., Skalidakis, S., Psarras, J.* (2019). University process optimisation through smart curriculum design and blockchain-based student accreditation. *18th International Conference on WWW:* 93-100. DOI: 10.33965/icwi2019_201913L012

Kosba et al., 2015 – *Kosba, A, Miller, A., Shi, E., Wen, Z., Papamanthou, C.* (2015). Hawk: The Blockchain Model of Cryptography and Privacy-Preserving Smart Contracts. [Electronic resource]. URL: https://eprint.iacr.org/2015/675.pdf

Koyfmann, Tabernakulov, 2019 – *Koyfmann, Ya., Tabernakulov, A.* (2019). Blokcheyn na praktike [Blockchain in Practice]. Moskva: Alpina Publisher. [in Russian]

Mikheenko et al., 2018 – *Mikheenko, O., Novikov, S., Novikov, P.* (2018). Biometricheskaya autenfikatsiya lichnosti, na osnove blokcheyn tekhnologii, kak nepremennoe uslovie tsifrovoy ekonomiki [Blockchain-Based Personality Biometric Authentication as an Obligatory Condition of Digital Economy]. *Vestnik Bryanskogo tekhnicheskogo universiteta*. 6: 76-83. DOI: 10.30987/article_5b865671022392.97351224 [in Russian]

MIT Media Lab, 2020 – MIT Media Lab. [Electronic resource]. URL: https://www.media.mit.edu

Myburgh, Tammaro, 2013 – *Myburgh, S., Tammaro, M.* (2013). Exploring Education for Digital Librarians. *Chandos Publishing*: 334.

Nakamoto, 2008 – *Nakamoto, S.* (2008). Bitcoin: A Peer-to-Peer Electronic Cash System. [Electronic resource]. URL: https://bitcoin.org/ bitcoin.pdf

Nespor, 2019 – *Nespor, J.* (2019). Cyber schooling and the accumulation of school time. *Pedagogy, Culture & Society*. 3: 325-341. DOI: 10.1080/14681366.2018.1489888

Ocheja et al., 2019 – *Ocheja, P., Flanagan, B., Ueda, H., Ogata, H.* (2019). Managing lifelong learning records through blockchain. *Research and Practice in Technology Enhanced Learning*. 14(1). DOI :https://doi.org/10.1186/s41039-019-0097-0

Qin, 2018 – *Qin, D., Wang, C., Jiang, Y.* (2018). RPchain: A Blockchain-Based Academic Social Networking Service for Credible Reputation Building. Lecture Notes in Computer Science, vol.10974. [Electronic resource]. URL: https://www.springerprofessional.de/en/rpchain-a-blockchain-based-academic-social-networking-service-fo/15865524

Rakhmanova, 2017 – *Rakhmanova, V.* (2017). Pochemu investory vidyat potentsial v rossiyskom rynke onlayn-obrazovaniya i obrazovatel'nykh tekhnologiy: Issledovanie izdaniya East-West Digital News, Netologii Grupp, FRII i drugikh kompaniy [Why Investors See a Potential in the Russian Market of Online Education and Educational Technologies: Research by East-West Digital News, Netologia Group, FRII, and Other Companies]. [Electronic resource]. URL: https://vc.ru/flood/23296-edtech-investigation [in Russian]

Rashidet et al., 2019 – *Rashid, M., Deo, K., Prasad, D., Singh, K., Chand, S., Assaf, M.* (2019). TEduChain: A Platform for Crowdsourcing Tertiary Education Fund using Blockchain Technology. [Electronic resource]. URL: https://arxiv.org/pdf/1901.06327.pdf

Rooksby, Dimitrov, 2017 – *Rooksby, J., Dimitrov, K.* (2017). Trustless education? A blockchain system for university grades. *New Value Transactions: Understanding and Designing for Distributed Autonomous Organisations*. [Electronic resource]. URL: http://johnrooksby.org/papers/DAOworkshop_rooksby.pdf

Rooksby, Dimitrov, 2017 – *Rooksby, J., Dimitrov, K.* (2017). Trustless education? A blockchain system for university grades [Electronic resource]. URL: http://johnrooksby.org/ papersDAOworkshop_rooksby.pdf

Rudich, 2020 – *Rudich, K.* (2020). Ed Clark, Universitet Sent-Tomasa: "U segodnyashnikh molodykh lyudey uzhe est' tsifrovaya lichnost' naryadu s real'noy" [Ed Clark, University of St. Thomas: "Present-Day Young People Have Already Obtained a Digital Personality in Addition to Their Real One"]. [Electronic resource]. URL: https://hightech.fm/2020/01/20/ed-clark [in Russian]

Scott, Mota, 2014 – *Scott, D., Mota, R.* (2014). Education for Innovation and Independent Learning. *Elsevier*: 168.

Selingo, 2017 – *Selingo, J.* (2017). The future of the degree: How colleges can survive the new credential economy. The Chronicle of Higher Education. [Electronic resource]. URL: https://www.pearson.com/content/dam/one-dot-com/one-dot-com/us/en/files/The-Future-Of-the-Degree-2017.pdf

Shamsutdinova, 2018 – *Shamsutdinova, T.* (2018). Application of the blockchain technology for digital diplomas: problems and prospects. *Open education*. 22(6): 52-61. DOI: 10.21686/1818-4243-2018-6-51-58

Sharples, Domingue, 2016 – *Sharples, M., Domingue, J.* (2016). The Blockchain and Kudos: A Distributed System for Educational Record, Reputation and Reward. Verbert K., Sharples M., Klobučar T. (eds). *Adaptive and Adaptable Learning*. *Lecture Notes in Computer Science*. Vol. 9891. Springer: 490-496. DOI: 10.1007/978-3-319-45153-4_48

Skiba, 2017 – *Skiba, D.J.* (2017). The Potential of Blockchain in Education and Health Care. *Nursing Education Perspectives*. 38(4): 220-221. DOI: 10.1097/01.NEP.0000000000000190

Sony Global Education, 2016 – Sony Global Education. Sony Global Education Develops Technology Using Blockchain for Open Sharing of Academic Proficiency and Progress Records. 2016. [Electronic resource]. URL: https://www.sony.net/SonyInfo/News/Press/201602/16-0222E/

Spies, Brothers, 2020 – *Spies, M., Brothers, P.* (2020). Education in 2030. Five Scenarios for the Future of Learning and Talent [report] Holoniq.com [Electronic resource]. URL: https://www.holoniq.com/wp-content/uploads/2020/01/HolonIQ-Education-in-2030.pdf

Stachokas, 2019 – *Stachokas, G.* (2019). The Role of the Electronic Resources Librarian. *Chandos Publishing*: 176.

Swan, 2015 – *Swan, M.* (2015). Blockchain: Blueprint for a New Economy, 1st edn. O'Reilly Media, Sebastopol, CA.

Szabo, 1996 – *Szabo, N.* (1996). Smart Contracts: Building Blocks for Digital Markets. [Electronic resource]. URL: http://www.fon.hum.uva.nl/rob/Courses/Information InSpeech/CDROM/Literature/LOTwinterschool2006/szabo.best.vwh.net/smart_contracts_2.html

Tapscott, Kaplan, 2019 – *Tapscott, D., Kaplan, A.* (2019). Blockchain Revolution in Education and Lifelong Learning. *Blockchain Research Institute and IBM Institute for Business Value*: 46. [Electronic resource]. URL: https://www.ibm.com/downloads/cas/93DDVAKE

Tapscott, Tapscott, 2017 – *Tapscott, D., Tapscott, A.* (2017). The Blockchain Revolution and Higher Education. [Electronic resource]. URL: https://er.educause.edu/-/media/files/articles/ 2017/3/erm1721.pdf

Turkanović et al., 2019 – *Turkanović, M., Hölbl, M., Košič, K., Heričko, M., Kamišalić, A.* (2019). EduCTX: A Blockchain-Based Higher Education Credit Platform. *IEEE Access*, 6: 5112-5127. DOI: 10.1109/ACCESS.2018.2789929

UNIC, 2014 – UNIC. Publication of Academic Certificates (2014). [Electronic resource]. URL: https://www.unic.ac.cy/iff/blockchain-certificates/

Vakurin et al., 2018 – *Vakurin, M., Ismagilov, S., Khazeev D.* (2018). Tekhnologiya blokcheĭn v sisteme vzaimodeystviya studenta i rabotodatelya [Blockchain Technology in the System of Interaction between a Student and a Professor]. *XIV Mezhdunarodnaya nauchno-prakticheskaya konferentsiya*. Tomsk: 132-134. [Electronic resource]. URL: https://elibrary.ru/ item.asp?id=37384519& [in Russian]

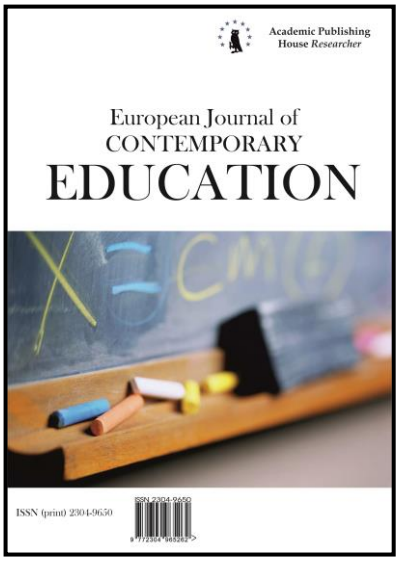
Xu et al., 2017 – *Xu, Y., Zhao, S., Kong, L., Zheng, Y., Zhang, S., Li, O.* (2017). ECBC: A High Performance Educational Certificate Blockchain with Efficient Query. *Theoretical Aspects of Computing*: 288-304. DOI: 10.1007/978-3-319-67729-3_17

Yumna et al., 2019 – *Yumna, H., Murad Khan, M., Ikram, M., Noreen, S., Sabeen, R.* (2019). Use of blockchain in Education: a Systematic Literature Review. In book: *Intelligent Information and Database Systems:* 191-202. DOI: 10.1007/978-3-030-14802-7_17

Zaslavsky, 2018 – *Zaslavsky, A.A.* (2018). Prospects for the use of blockchain algorithms to ensure security in the management of the educational organization. *RUDN Journal of Informatization of Education*. 15 (1): 101-106. DOI 10.22363/2312-8631-2018-15-1-101-106

Zhou et al., 2020 – *Zhou, L., Zhang, L., Zhao, Y.* (2020). A scientometric review of blockchain research. *Information Systems and e-Business Managemen*t. DOI: 10.1186/s40854-019-0147-z

Published in the Slovak Republic
European Journal of Contemporary Education
E-ISSN 2305-6746
2020, 9(3): 572-583
DOI: 10.13187/ejced.2020.3.572
www.ejournal1.com



Cultivation of the Skills of Design Thinking via the Project-Based Method as a Component of the Dual Model of Learning

Andrii E. Lebid [a, b, *], Natal'ya A. Shevchenko [b, c]

[a] Sumy State University, Ukraine
[b] International Network Center for Fundamental and Applied Research, Washington, USA
[c] Volgograd State University, Volgograd, Russian Federation

Abstract

This paper outlines some of the key changes to cultivating relevant capabilities, skills, and competencies that are expected of university graduates today. Transformation processes in this area are calling for the creation of a relevant system of workforce education and training, with a focus on optimizing the conditions for combining work and training. This issue could be resolved via a set of activities on developing special models of mutually beneficial relationships between educational institutions, employers, and stakeholders. Such activities will be aimed at ensuring the practical preparation of education seekers for independent professional activity and their social adaptation in work teams, proper regulatory-legal and organizational support, the conduct of testing, the conduct of research, the fine-tuning of such models, and the development of recommendations on the use of such models on a wider scale.

The dual model of learning, currently regarded by many as quite successful, combines effective innovative techniques and methodologies, including those founded on the project-based method. Through the example of the experience of several Ukrainian universities, specifically Sumy State University, with respect to the conduct of project-based activity, the authors describe the role of this type of activity in fostering the skills of design thinking with a focus on streamlining the experience of engaging in project-based and research activity.

The authors' calculations using the Pearson correlation coefficient and the F-test helped establish that how many projects will be undertaken does not directly depend on the number of project groups.

Keywords: design thinking, innovation-focused pedagogy, project-based method, dual model of learning.

* Corresponding author
E-mail addresses: schwarzschwanenreich@gmail.com (A. Lebid)

1. Introduction

The purpose of just about any educational program is to provide students with general scholarly and professional-practical training that will enable them to perform confidently a set of professional duties in a certain field, guarantee their being sought after and competitive in the labor market, and provide broad vistas for self-actualization in their profession, further education, and self-education. It is hardly possible to achieve this objective in the conditions of today without supplementing basic theoretical training with high-quality practical training delivered to students through engaging them in direct activity in a company in their field – both as a volunteer and as a participant in a joint project via an agreement.

Formal training provided by universities and practical on-site training in a company in one's field could be combined via the use of the dual model of learning, with a focus on fostering design thinking, including via the project-based method. Given that many universities around the world have lots of positive experience in this area, the approach merits close study and adaptation across the global educational environment.

One of the author's previous works examines some of the latest challenges and trends in the development of the labor market and discusses the need for implementing in the educational process special methodologies and mechanisms for fostering systems thinking – as a crucial element of general scholarly and media education and a must-have skill in light of today's economic realities (Lebid, Shevchenko, 2020). In this regard, it is worth noting the fact that most present-day universities strive to react to challenges and emerging trends by streamlining their programs and courses in keeping with changes taking place around the world.

The professional world is constantly developing, and today this evolution is largely spurred by advances in technology. Despite this, today's emerging skills are more about emphasizing innately human capabilities (e.g., those related to thinking, communication, leadership, etc.) than manipulating machines.

With this in mind, most major universities are interested in fostering and developing "elemental" capabilities and skills in their graduates (e.g., systems analysis and evaluation, creativity, originality, and initiative, technology design and programming (Harvard PD, 2020), time management and learning strategy development, planning, design, analysis and examination skills (DCE, University of Oxford, 2020), intellectual skills, communication skills, and organization and research skills (SP, University of Cambridge, 2020; PSMs, Yale University, 2020).

The above list of capabilities and skills for modern-day university graduates reflects the actual situation with the system of professional and general competencies today, when it is no longer sufficient to focus on conventional models of knowledge management and there is a need to foster the skills of subject-to-subject interaction, with design thinking appearing to be one of them.

Design thinking implies the use of creative techniques, the ability to ask questions and work in a team, being interested, optimism, being oriented toward people, and the ability to generate new solutions and come up with creative ways of accommodating the needs of other people, companies, educational institutions, and society as a whole. Design thinking can help the subjects of the educational process detect and resolve problem situations during the process of learning.

2. Materials and methods

In conducting the research reported in this paper, the author analyzed curricula and syllabi in and across specific disciplines and core competencies to be mastered by graduates of some of the world's top universities (e.g., Harvard, Oxford, Yale, Cambridge, etc.). The author examined the development of such competencies through the lens of using the project-based method in pedagogy with a focus on employing unconventional, creative, and innovative approaches to fostering design thinking in students.

A key component of this study is the following key principles of the dual model of learning:

– a focus on practice-oriented learning;

– the use of active forms of organizing the educational process;

– the use of innovative pedagogical technologies;

– a focus on subject-to-subject pedagogy, built on a model of partnership between students, instructors, employers, and stakeholders;

– a wide use of practical cases in the educational process;

– a focus on problem-based learning.

Each of the above items encompasses several crucial areas of work focused on resolving issues of an organizational, communication, pedagogical, and instructional nature in a stage-by-stage manner.

In addition, the study employed methods of statistical analysis of quantitative data and statistical methods of data processing, specifically computing the Pearson correlation coefficient and using the F-test to assess statistical significance.

3. Discussion

The development of design thinking has been the subject of extensive research. The key areas of this research include the following: employing design pedagogy methodologies in teaching the fundamentals of entrepreneurship (Sarooghi et al., 2019), exploring design thinking as a sought-after skill for future engineers (Soboleva, Karavaev, 2020) and health and medical workers (Badwan et al., 2018), and exploring design thinking as the basis of interactive group learning (Woolard, 2018; Clemmensen et al., 2018).

A separate group of research works is represented by research into the use of the project-based method in pedagogy and in the process of fostering design thinking. Elsewhere, one may find some interest in research into procedural knowledge of project-based activity (Chon, Sim, 2019) and research that places project-based activity in the context of developing a strategy for development (Ben et al., 2016).

Scholar G. Lutsenko, who has analyzed the current condition of Ukraine's system of engineering education, has noted the prevalence in it of traditional pedagogical approaches, whilst many universities are currently employing the problem- and project-based learning model, with a focus on fostering in a person the capabilities and skills that are the most sought-after in the labor market today (Lutsenko, 2018).

In this context, it is worth noting that Ukrainian universities are gradually joining in and starting to adopt some of the globally recognized practices for organizing the educational process factoring in the latest trends. One such institution of higher learning is Sumy State University. This college has built a system of administering, organizing, monitoring, evaluating, and analyzing the educational process based on the principles of dual learning, which has helped it achieve high positions on various international rankings (e.g., Times Higher Education World University Rankings, QS World University Rankings, Webometrics Ranking of World Universities, U-Multirank, SciMago Institutions Rankings, Shanghai Ranking, etc.).

Scholars S. Bećirović, F. Hodžić, and A. Brdarević-Čeljo have stressed the need to foster in students a set of soft skills, particularly critical thinking skills. The findings from a research study conducted by this group of researchers are suggestive of the need to overhaul existing curricula and teaching strategies to bring them in conformity with the latest educational standards with a view to implementing and expanding methodologies and approaches that can facilitate the development of soft skills and critical thinking skills (Bećirović et al., 2019).

Today, there is a growing need for a workforce that has the ability to not just analytically respond to routine tasks but also employ unconventional algorithms to resolve them, which, as suggested by a study conducted by scholars H. Sarooghi, S. Sunny, J. Hornsby, and S. Fernhaber, involves the use of the skills of design thinking. According to this group of researchers, while entrepreneurship education *has* embraced a design thinking lens, as evidenced by the increasing number of curricula incorporating processes that have roots in design, there remains limited understanding of the conceptual underpinnings and the implementation of such practices (Sarooghi et al., 2019).

The need to foster design thinking as a special type of thinking has been pointed out by scholars E. Soboleva and N. Karavaev. In their view, this type of thinking is based on problem-solving and cognitive activity and aimed at solving socio-economic problems in the climate of the Fourth Industrial Revolution and amid the rapidly evolving digital economy. The researchers draw the conclusion that there is a need for putting in place a set of university courses with special interdisciplinary project-based forms of activity, which should create additional conditions for cultivating key capabilities, skills, and professional competencies in training specialists who will be sought after in a digital economy (Soboleva, Karavaev, 2020).

Today, there is little doubt that the priority is with the use of innovative approaches in education, promotion of teamwork, and development of group assignments and practical cases.

In this context, scholar N. Woolard sets great store by design pedagogy for the benefits it offers by way of interactive learning and working in small groups, with a focus on employing in the educational process the adaptive leadership model (Woolard, 2018).

In the view of researchers B. Badwan, R. Bothara, M. Latijnhouwers, A. Smithies, and J. Sandars, "design thinking provides a creative and innovative approach to solve a complex problem". The scholars are convinced that design thinking can help one "acquire essential transferable life-long learning skills", and suggest that the approach can be widely applied in medical education, from technology intervention projects to curriculum development (Badwan et al., 2018).

Scholars T. Clemmensen, A. Ranjan, and M. Bødker note in their study the growing trend of co-creation and co-design in cross-cultural design teams. The researchers integrate design thinking with the dynamic constructivist theory of culture to propose a situation-specific framework for the empirical analysis of design thinking in cross-cultural teams. The study's results provide some insight into how cultural knowledge shapes core design thinking in specific situations (Clemmensen et al., 2018).

Scholars D. Henriksen, S. Gretter, and C. Richardson suggest that, while design thinking is currently receiving increased scholarly and popular interest in education, teachers are often uncertain about how to implement it in their educational settings. The researchers, nonetheless, are convinced that design thinking offers a sound framework to address the challenging problems of practice educators get to face. In their article, the scholars share how the use of the Stanford Design Thinking Model in a graduate-level teacher education course helped the participants creatively solve problems of practice relevant to their context, with the following three main takeaways from the experience reported: (1) valuing empathy; (2) becoming open to uncertainty; (3) seeing teaching as design (Henriksen et al., 2020).

In the view of researchers D. Chin, K. Blair, R. Wolf, L. Conlin, M. Cutumisu, and J. Pfaffman, design thinking is one of the best tools for equipping "students with learning strategies they can apply when approaching new problems on their own". The study's findings indicate that design-thinking strategies are good for both curricular and extracurricular work. It is suggested that design-thinking instruction may improve the likelihood of lower-achieving students choosing to use effective strategies in novel settings that require new learning (Chin et al., 2019).

According to scholars H. Chon and J. Sim, the "process of design explicates the procedural knowledge of design activities, shifting theoretical conceptions across practical dimensions". The researchers note that this creative and innovative methodology is the result of research into implementing design thinking in the pedagogical process, which has established it as a designerly process for non-designers to address complex problems and generate new knowledge. The use of the design thinking methodology as the basis for decision making in design research and practice implies inducting students into an interdisciplinary project. The scholars suggest that the "perspectives and insights arising from the collaborative, design thinking methodology are extracted, analyzed, and adapted to form a framework to illustrate the non-linear, circular structures of knowledge generation from theory (designerly knowing) to practice (design thinking) and research (design knowing)" (Chon, Sim, 2019).

An obvious fact today is that standard approaches to project management are ill-suited to address changes in the environment or business needs, particularly in innovative contexts characterized by uncertainty and complexity. In the view of scholars M.-J. Ben, C. Midler, and P. Silberzahn, instead of being concerned with the efficient implementation of a deliberate strategy, a project in such a context becomes a process for strategy formulation, with the following three imperatives for project management arising as a result: (1) managing the explorative phase; (2) managing the involvement of stakeholders in the project; (3) managing the project in relation to the firm's strategizing process. The researchers suggest that design thinking can make a number of important contributions to these imperatives (Benet al., 2016).

Thus, project-based and design thinking have been recognized by the scholarly community and practitioners as a new methodology that can be efficient in innovation activity in the areas of research, management, and teaching.

4. Results

In recent years, design has transformed from a tool that helps boost consumption into one that helps create new values by way of innovative projects and solutions with a view to simplifying and humanizing a product or service. One of the first scholars to bring up the interdisciplinary nature of design thinking was R. Fuller (Fuller, 1997). In the late 1960s, scholar H. Simon proposed an anthropocentric doctrine of design thinking – rapid prototyping and testing through observation (Simon, 1996). Scholar D. Norman invokes the participatory design approach, which emerged in Scandinavia, to propose an improved formula for it – user-centered design (Norman, 2013). In the view of V. Papanek, it is hardly possible to achieve high quality, effective design without the use of anthropological research (Papanek, 1973).

Thus, so far the following key principles of design thinking have been formulated: interdisciplinarity, prototype creation and testing, anthropological research into consumer needs and wishes, and designers' social responsibility.

Worthy of special mention is the Hasso Plattner Institute of Design at Stanford University, with its mission statement – 'We believe everyone has the capacity to be creative. The Stanford d.school is a place where people use design to develop their own creative potential'. D.school is a platform for researchers and experimenters engaged in the development of one of today's most sought-after skills – a capacity for systems and creative thinking.

Thus, design thinking is a method for creating products and services oriented toward a person, a process that implies taking account of a person's values, needs, motivation, and problems. Design thinking is a mode of thought and a worldview oriented toward creativity and innovation. The key purpose of design thinking is to generate new solutions and come up with creative ways of providing for the needs of others in an efficient manner.

Design thinking is distinguished from other methods in a number of ways. Firstly, it is its orientation toward a person. Secondly, it is its focus on creative cooperation. Design thinking encourages teamwork and ideas exchange in a format of interdisciplinary discourse. Thirdly, it is its focus on experimentality and optimism. There is nothing wrong with making mistakes occasionally, as long as you learn from them. Indeed, involvement in unconventional situations may lead to valuable insights and unexpected solutions. Fourthly, it is its non-linearity. Design thinking is non-linear and highly flexible, despite being structured in a logical manner in the process of looking for solutions to unconventional problems.

Today, design thinking is employed across a wide spectrum of activities, including social entrepreneurship (e.g., Clean Team, Marc Koska's K1, etc.), business (e.g., Vlisco, MRI scanning for children, etc.), nongovernmental organizations (e.g., Jerry Sternin's project, Vroom, etc.), the public sector (e.g., The Good Kitchen, live|work, etc.), etc. The design thinking method appears to work most efficiently in the area of interdisciplinary research, projects, and initiatives.

In addition, today design thinking is used widely in pedagogical practice. While this method is primarily used in business to gain insight into clients' needs, with a focus not on imposing your own vision on them but on taking account of their needs, education is a service too, with many instructors tending not to concern themselves with the wishes and needs of the client – the student. In this regard, the key objective behind design thinking is to replace the subject-to-object pedagogical model with the subject-to-subject model, which implies relationships between equal partners. There appears to be a need to renounce paternalism in teaching and encourage empathetic communication between the teacher and the student. As a bottom line, there is a need to engage the student in the decision-making process.

Today, subject-to-subject pedagogy is not only about a partnership between the teacher and the student but also about cooperation with the employer and the stakeholder. This triune synthesis should help develop effective educational strategies and programs. The potential for this type of dialogue is there, and it can be exploited via the dual model of learning.

The classic version of the dual model of learning combines university study and workplace learning, with a focus on acquiring relevant skills and competencies. The fundamental principles of the dual model of learning are an increased study load to be completed in the workplace, employers taking a direct part in the development and coordination of educational programs, in the implementation thereof, and in the assessment of students' academic progress, and students performing bespoke research work for employers.

Today, the proper fulfillment of the principles of dual learning is possible only through taking a systems approach to organizing the educational process. In a system of this kind, a proper place and appropriate functions ought to be reserved for education authorities, government and local authorities, companies and organizations (i.e., potential customers for a workforce), various territorial communities, non-governmental organizations, professional associations, and other entities.

The existing practice of implementing the dual model of learning in universities attests to a focus on systemicity in implementing this type of educational practice and helps identify some of the key components of specialist training via the dual model, which are as follows:

– a close link between theory and practice, with the practical component being a mandatory part of the educational process;

– the use of active forms of organizing students' academic work and innovative pedagogical technologies;

– the availability of flexible work and class schedules, which are coordinated with the companies or partner organizations to enable the holding of practical classes at them;

– an opportunity to explore in practical classes specific situations and cases from the experience of partner organizations and then reenact them on site;

– a partner organization taking part in the development of curricula and the subject matter of term and diploma papers;

– student performance being evaluated by a company serving as a practical training base, which enables prompt reacting to the needs of the labor market and helps make the educational program flexible, mobile, and effective;

– students engaging in real communication with the target groups, which enables them to acquire, alongside relevant professional qualifications, a set of crucial social and communicative competencies, which should help them build a successful career in the future.

Specifically, the above-mentioned technologies associated with the dual model of learning involve cultivating systematic cooperation with employers in terms of ensuring proper practical training and enhancing the substantive part of educational programs, as well as orienting the universities toward the use in pedagogical activity of innovative technologies and approaches under a flexible organizational and management structure that will be capable of taking up and supporting innovations and reacting promptly to the changing conditions and needs of the labor market.

With that said, it is worth noting that the effectiveness of the system of dual learning is ensured via the consistent and systematic implementation of the above-mentioned fundamental approaches and principles and is the combined responsibility of all participants in the process.

It follows from what was said above that one of the foundations of the dual model of learning is the project-based method, which aims to engage the seeker of higher education in the real processes of their professional growth. The author views the use of project-based activity as not just a way to keep pace with current trends but as a real and powerful tool for ensuring the practical training of specialists. Engaging students in project-based activity appears to be crucial from a standpoint of fostering in them both professional and general competencies.

Systematic work with employers and training bases is an indispensable condition for engaging students in project-based activity. It helps select for each student, within the frame of studying particular disciplines, just those forms of work and tasks within the frame of a project's topic that are interesting to them, lend themselves to implementation, can be objectively assessed, and will potentially be useful in the graduate's future professional activity.

At the same time, the author does not view engaging students in project-based activity only as a way to fulfill the practical component within the frame of particular disciplines that are oriented directly toward this kind of activity. Of utmost significance is engaging students in project-based activity throughout the period of study, with approaches of this kind being particularly significant within the frame of the implementation of the dual model of learning.

Project-based learning is an effective and relevant approach to teaching and learning. Implementing it in the pedagogical process helps enhance student motivation for learning and raise the level of student achievement. On one hand, the use of the project-based model helps implement a program of early career guidance for students, and, on the other hand, it helps cultivate and reinforce through practice the professional capabilities and skills a university graduate must possess.

Since learning is a social activity, through project-based learning students can not only put their knowledge of academic disciplines to actual use but also learn to negotiate, make joint decisions, take responsibility as a teammate, and interpret the outcomes of their activity in a collective manner.

This also helps develop a student's innate intellectual abilities via the use of unconventional, innovative approaches. A key benefit of using the project-based approach in learning is that project-based learning is implemented through interdisciplinary linkages that extend beyond the scope of a particular academic discipline. This helps expand significantly the potential for participants in the educational process, facilitating boosts in creativity and the acquisition of crucial practical skills.

Projects, which are different from each other in orientation, level (local, regional, national, or international), subject matter, duration, or funding, could provide, based on effective organizational and instructional work, a foundation for quality academic work and creative activity on the part of students and significant potential for serious independent work.

On the instructor's side, this work includes continual monitoring of relevant resources; preparation of a suite of possible projects; organization of work on preparing project applications; keeping track of the characteristics of academic disciplines and employing relevant interdisciplinary approaches so as to achieve maximum effect in fostering student competencies.

In a general sense, student project-based activity is a lot broader than the traditional spectrum of communications and is oriented not only toward the academic community but toward the public sector, government and local authorities, and international organizations as well.

To summarize the experience of Sumy State University, within the frame of various disciplines and in different years of study students are engaged in project implementation at different levels and are given different objectives. For instance, first-year students receive simple assignments, like familiarizing oneself with the activity of a center or a nongovernmental organization, taking part in a special event or a flashmob, or organizing one, analyzing one's own experience and experiences, analyzing the reaction of other participants, etc.

The next stage involves working on tasks that are somewhat different in nature, with students not only immersing deeper into the idea but testing particular technologies as well. This kind of "immersion" is particularly useful in working on the practical part of one's term assignment. Students can also get a handle on implementing the monitoring component of projects via relevant problems within the frame of various courses. Problems of this kind may deal with assessing particular stages of a project from the side of a target group, taking part in the conduct of focus-group research, taking part in the collection of statistical data, etc. In the senior years of study, the curriculum may include term assignments on project management with a view to consolidating, systematizing, and complexifying one's skills through a more complex instrumentarium for project-based activity. It is for this reason that it so important for a university and its departments to develop a suite of active projects on various topics and for various target groups.

Engaging students in project-based activity within the frame of the dual model of learning involves the conduct of systematic organizational-instructional work. This is about organizing the logic behind the curriculum and working out relevant educational programs with a focus both on having them cover fundamental theory and on linking their content with specific training bases and their active projects, with a view to helping one develop a set of professional competencies and skills crucial to the development of one's own projects.

Thus, the project component is one of the key factors in modern-day education. Evidence from experience suggests that engaging students in project-based activity helps foster and develop in them the skills that most employers look for in their candidates. A good example to illustrate this is the fact that, under the aegis of the International Foundation for Electoral Systems (IFES), in 2019 eight and in 2020 14 more Ukrainian universities joined a special program designed to teach an integrated course named 'Democracy: From Theory to Practice', which mandatorily involves the implementation of a student project.

As part of a project, students explore a problem faced by a specific target group. To investigate it as thoroughly as possible in order to determine its causes and resolve it, they develop an appropriate action plan. This process consists of several stages. Students get to examine each of the course's topics in the context of the problem selected for study, with a focus on addressing issues of the following kind: determining whether a problem has to do with human

rights and suggesting possible ways to resolve it, determining the responsibility for a problem on the part of the authorities and suggesting possible ways to resolve it, determining the role that could be played by civil society in resolving a problem, suggesting possible ways for citizens themselves to resolve a problem, etc.

In the context of said course, the author visited over 10 workshops designed to test various interactive learning methods, explore various algorithms related to project-based activity, and gain an insight into the key components of project-based activity, and that is considering that the author already had an appreciable amount of experience in project-based activity.

To support the idea that the system of student project-based activity has really worked in Ukrainian universities, it should be noted that during the spring term of 2020 the Democracy: From Theory to Practice course was attended, according to IFES, by as many as 959 students. Each student project was handled by a group of four to six students, i.e. as part of the course nearly 190 projects on various topics were implemented (Table 1).

Table 1. Student Project Subject Areas (Ukraine)

	Project subject area	Total number of projects, %
1	Charity; aid for orphaned children	2
2	Countering corruption	5
3	Countering bullying; preventing school violence	5
4	Protection of human rights	10
5	Promoting healthy lifestyles	4
6	Inclusion	11
7	Media literacy	3
8	Conducting public hearings	1
9	Countering domestic violence	10
10	Countering juvenile crime	11
11	Youth participation in elections	9
12	Financial literacy	2
13	Fostering active citizenship among the population	18
14	Environmental protection	9

While by no means an exhaustive list of student projects, it does reflect some of the trends, issues, and interests common to young people today. Note that a student project is not exclusively of a descriptive nature – on the contrary, it implies organizing specific activities, including all kinds of events, aimed at creating a stir among the general public, drawing attention to various social issues existing in society.

Based on the total number of students who took the Democracy: From Theory to Practice course and were engaged in project-based activity, the author calculated the total number of potential project groups, including through the lens of their gender characteristics in the context of both all the Ukrainian universities where the course was offered and Sumy State University in particular.

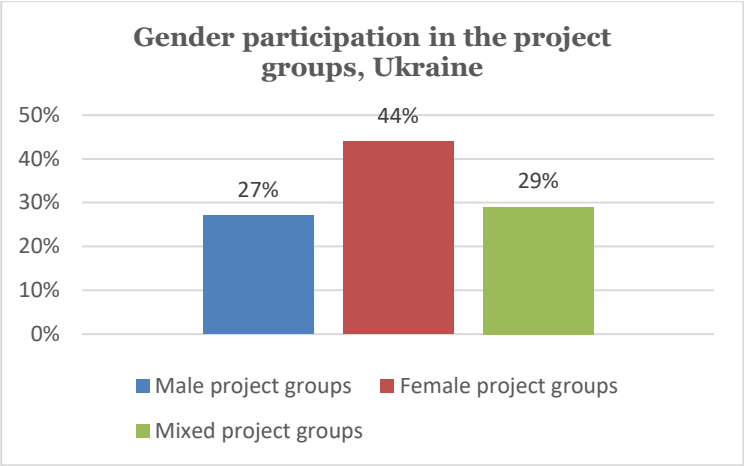


Fig. 1. Gender participation in the project groups (Ukraine)

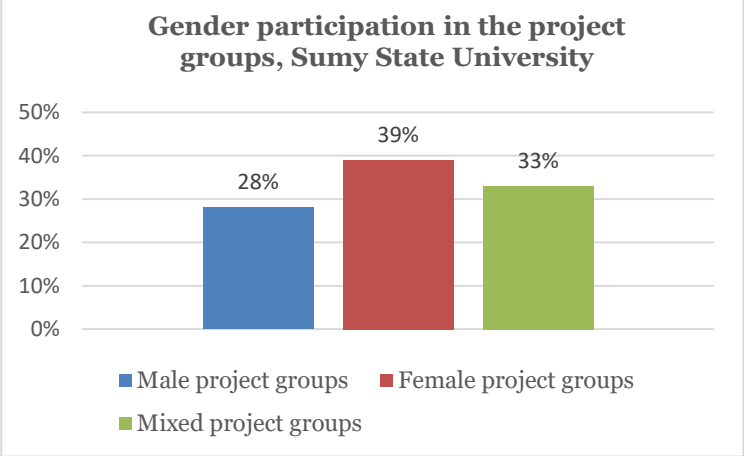


Fig. 2. Gender participation in the project groups (Sumy State University)

To determine the discrepancies between the empirical (observed) and theoretical (expected) frequencies, the author analyzed the performance of project teams at Sumy State University in the fall term of 2019 and the spring term of 2020, which is when the Democracy: From Theory to Practice course was actually taught, with a student project implemented as a mandatory part of it.

Based on the number of students who attended the course during said period, the author calculated the total number of project teams and potential projects undertaken by them on the assumption that one project group undertakes one project (Table 2), and computed gender participation in the project groups (Figure 2).

Table 2. Number of Project Groups (Sumy State University)

	Male project groups	Female project groups	Mixed project groups	Male project groups	Female project groups	Mixed project groups
	Results observed			Results expected		
Year 2019	13	21	17	14	20	17
Year 2020	11	13	12	10	14	12

To determine statistical significance, the author used the non-parametric χ2 test. The following hypothesis was formulated: H_o – the number of projects undertaken does not depend on the number of project groups. The following formula was used:

$$\chi_n^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i}$$

The calculations produced the following values: $\chi^2 = 0.292$ and $p = 0.865$. Comparing the latter with the standard value ($p = 0.05$) leads to the conclusion that we cannot reject the null hypothesis, as the results do not satisfy the condition $p \leq 0.05$. Thus, it turns out that there is no direct relationship between the number of project groups and the number of projects undertaken by them, as one project group could undertake between one and several projects or it could undertake no projects whatsoever. Note that such cases *did* take place.

Moreover, there were cases of students engaging in no projects whatsoever, as well as cases of a project group being formed but failing to formulate its project's topic and then implement it. There were cases of project groups being reformatted or dissolving themselves, with their members exiting of their own accord. In the end, these factors had an effect on the quantitative results and their analysis.

A question of interest is to see which is the most popular project topic across the project groups and if there are purely "male" or purely "female" projects out there. Based on the findings from the author's analysis, such a division does exist (Table 3).

Table 3. Gender Preferences in Terms of Project Subject Area (Ukraine)

Project group	Project subject area
Male project groups	1; 2; 7; 8; 12
Female project groups	3; 4; 6; 9; 14
Mixed project groups	5; 10; 11; 13

Comparing the data in Table 1 with that in Table 3, it can be seen that the male project groups were mainly focused on working on Project Topic 1 (2 % of the total number of projects), 2 – 5 %, 7 – 3 %, 8 – 1 %, and 12 – 2 %, i.e. a total of 13 % of the total number of projects. Similar calculations were performed with regard to projects implemented by the other two project groups, with the female project groups implementing a total of 45 % of the projects and the mixed ones – 42 % of the projects.

In this context, it is possible to speak of the calculations being somewhat tentative and variable, as there were dynamic differences in the project groups' preferences in terms of project subject area. However, these deviations were within the measurement accuracy, so they did not affect the experiment's integrity much.

Of interest is the fact that different project groups chose different formats of conducting a project activity, with the male groups tending to employ monologue-based types of activity (e.g., information distribution, public lectures, presentations, etc.), and the female project groups tending to utilize more interactive, dialogue-based, forms and methods (e.g., flashmobs, workshops, advocacy, facilitation, etc.).

The answer to the question 'What is to be done to develop the skills of design and project-based thinking?' is obvious – 'to study and to practice them'. The process of learning and fostering these skills is what student projects are all about.

5. Conclusion

Design and project-based thinking is a methodology for generating innovations that is being keenly used today by Google, Apple, Samsung, and other major companies. It is about speeding up communications in a team and structuring the processes of generation and implementation of ideas. What is central to this methodology is ensuring an optimal user experience from interacting with a product or service. With that said, the physical parameters, mainstream to most of us, are secondary here, although they are still quite important for the user experience.

The present-day education system is shifting from the traditional model of the teacher transmitting information to the students to a focus on cultivating essential skills and competencies sought after in today's world. This includes developing the skills of working in a team, fostering emotional intelligence, and cultivating the skills of critical and creative thinking.

The use of design thinking in project and research activity facilitates the development of many crucial skills, and is the result of a person gaining experience during the process of solving problems. By teaching children design thinking, we can start preparing them already today for their future innovation-focused activity.

The author's calculations using methods of statistical analysis and data processing helped draw the conclusion that the significance level value alone will not tell us anything about the probability of the null hypothesis being true. The p value is always computed assuming the null hypothesis is true. Of importance is also the fact that, if $p > 0.05$ (5 %) and H_0 is not rejected (as is the case in this study), we cannot state so unequivocally that there are no differences. They could have been there, but we were unable to find them with our sample – there might be a problem with the actual sample, with the way it is designed. The results confirm the hypothesis that the number of projects does not depend on the number of project groups, which is supported by an analysis of the data in Figures 1, 2, and Table 3.

References

Badwan et al., 2018 – *Badwan, B., Bothara, R., Latijnhouwers, M., Smithies, A., Sandars, J.* (2018). The importance of design thinking in medical education. *Medical Teacher*. 40(4): 425-426.

Bećirović et al., 2019 – *Bećirović, S., Hodžić, F., Brdarević-Čeljo, A.* (2019). Critical Thinking Development in the Milieu of High School Education. *European Journal of Contemporary Education*. 8(3): 469-482.

Ben et al., 2016 – *Ben, M.-J., Midler, C., Silberzahn, P.* (2016). Contributions of Design Thinking to Project Management in an Innovation Context. *Project Management Journal*. 47(2): 144-156.

Chin et al., 2019 – *Chin, D., Blair, K., Wolf, R., Conlin, L., Cutumisu, M., Pfaffman, J.* (2019). Educating and Measuring Choice: A Test of the Transfer of Design Thinking in Problem Solving and Learning. *Journal of the Learning Sciences*. 28(3): 337-380.

Chon, Sim, 2019 – *Chon, H., Sim, J.* (2019). From design thinking to design knowing: An educational perspective. *Art, Design & Communication in Higher Education*. 18(2): 187-200.

Clemmensen et al., 2018 – *Clemmensen, T., Ranjan, A., Bødker, M.* (2018). How cultural knowledge shapes core design thinking – a situation specific analysis. *CoDesign: International Journal of CoCreation in Design and the Arts*. 14(2): 115-132.

DCE, University of Oxford, 2020 – Study skills for students // Department for Continuing Educatin University of Oxford. 2020. [Electronic resource]. URL: https://www.conted.ox.ac.uk/about/student-study-skills

Fuller, 1997 – *Fuller, R.* (1997). Synergetics. Explorations in the Geometry of Thinking. Macmillan Publishing Company, 1997

Harvard PD, 2020 – Harvard Professional Development. 10 Emerging Skills for Professionals. 2020. [Electronic resource]. URL: https://blog.dce.harvard.edu/professional-development/10-emerging-skills-professionals

Henriksen et al., 2020 – *Henriksen, D., Gretter, S., Richardson, C.* (2020). Design thinking and the practicing teacher: addressing problems of practice in teacher education. *Teaching Education*. 31(2): 209-229.

Lawson, 2005 – *Lawson, B.* (2005). How Designers Think: The Design Process Demystified (4th ed.). Architectural Press, 2005. 320 p.

Lebid, Shevchenko, 2020 – *Lebid, A., Shevchenko, N.* (2020). Cultivating the Skills of Systems Thinking in the Context of Fostering the Basic and Professional Competencies Associated with Media Education and Media Literacy. *International Journal of Media and Information Literacy*. 5(1): 60-68.

Lutsenko, 2018 – *Lutsenko, G.* (2018). Case study of a problem-based learning course of project management for senior engineering students. *European Journal of Engineering Education*. 43(6): 895-910.

McKim, 1980 – *McKim, R.* (1980). Experiences in Visual Thinking (2nd ed.). Cengage Learning, 1980. 183 p.

Norman, 2013 – *Norman, D.* (2013). The Design of Everyday Things (revised and expanded ed.). Basic Books, 2013. 368 p.

Papanek, 1973 – *Papanek, V.* (1973). Design for the real world. Bantam Book, 1973. 387 p.

PSMs, Yale University, 2020 – Professional Skills Modules. 2020. [Electronic resource]. URL: https://environment.yale.edu/academics/professional-practice/skills/

Sarooghi et al., 2019 – *Sarooghi, H., Sunny, S., Hornsby, J., Fernhaber, S.* (2019). Design Thinking and Entrepreneurship Education: Where Are We, and What Are the Possibilities? *Journal of Small Business Management*. 57(1): 78-93.

Simon, 1996 – *Simon, H.* (1996). The Sciences of the Artificial (3rd ed.). MIT Press, 1996. 241 p.

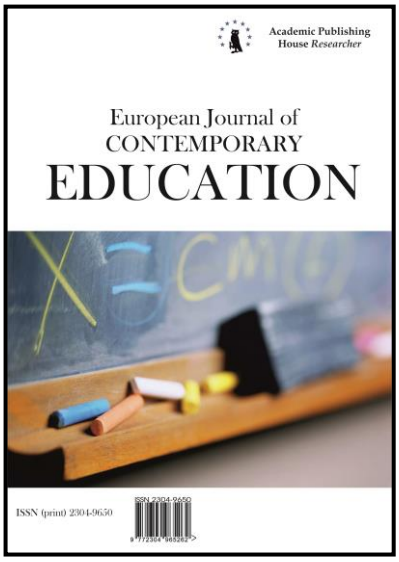
Soboleva, Karavaev, 2020 – *Soboleva, E., Karavaev, N.* (2020). Preparing Engineers of the Future: the Development of Environmental Thinking as a Universal Competency in Teaching Robotics. *European Journal of Contemporary Education*. 9(1): 160-176.

SP, University of Cambridge, 2020 – Key skills for undergraduates // Skills portal. University of Cambridge. 2020. [Electronic resource]. URL: https://www.transkills.admin.cam.ac.uk/skills-portal/key-skills-undergraduates

Values of the Chi-squared distribution – Values of the Chi-squared distribution. [Electronic resource]. URL: https://www.medcalc.org/manual/chi-square-table.php

Woolard, 2018 – *Woolard, N.* (2018). Rethinking management group projects with the adaptive leadership model: The lesson is the process. *Journal of Education for Business*. 93(8): 392-402.

Published in the Slovak Republic
European Journal of Contemporary Education
E-ISSN 2305-6746
2020, 9(3): 584-591
DOI: 10.13187/ejced.2020.3.584
www.ejournal1.com



Academic Motivation Among Traditional and Online University Students

Romualdas K. Malinauskas [a, *], Jurate Pozeriene [a]

[a] Lithuanian Sports University, Lithuania

Abstract

In this paper, the differences in academic motivation between university students of traditional (in-classroom) and online (distance) education were investigated. It has been hypothesized that online (distance) students possess stronger intrinsic motivation than traditional (in-classroom) students. The random sample consisted of 386 students. Participants comprised 189 male and 197 female students; 194 of them were traditional students, and 192 of them were online students. The cross-sectional research design was used in this study. A 21 item Academic Motivation Scale (SAMS-21) was used to measure three types of extrinsic motivation (intrinsic motivation to know, to accomplish things, and to experience stimulation), three types of extrinsic motivation (external, introjected, and identified regulation) and amotivation in university students. The findings indicated that students' intrinsic motivation scores were higher in online students than in students who attend traditional face-to-face classes. The results did not reveal significant differences between male and female students in terms of academic motivation. This study made a novel contribution to the literature, because the present study has compared academic motivation between university students of traditional and online education in a new context. i.e. before COVID-19 pandemic and during it. Recommendations are provided for further research into areas not covered by this study.

Keywords: academic motivation, online learning, traditional learning, university students.

1. Introduction

Researchers' attention to studies of academic motivation has not decreased in the last ten years. It is important to investigate academic motivation due to its significant influence on learning at university. Now, due to the COVID-19 pandemic researchers paid more attention to investigation of online (distance) education and to academic motivation among university students situated within online learning environments. The present study examines the differences in academic

* Corresponding author
E-mail addresses: Romualdas.Malinauskas@lsu.lt (R.K. Malinauskas)

motivation between university students of traditional (in-classroom) and online (distance) education.

There is no single, agreed definition of distance and online education due to the variance of what it includes at different universities. The term "distance education" is used to describe the teaching process when the instructor is remote (geographically separated) from the student (Gallagher, McCormick, 1999). Online learning is viewed here as a category of distance education (students can communicate at the same time with either the entire class, or the instructor only) that specifically uses the Internet when the students watch online lectures and interact with the educators and other students in online forums (Bates, 2005). In other words, online learning is a learning environment in which students are able to o in classes via Internet and/or computer technology (Hartnett et al., 2011). It is one popular method being used by universities in various countries to meet the needs of social distancing during the COVID-19 pandemic.

Many benefits of online education could be mentioned from the scientific literature. Online education is useful in eliminating the time and expense associated with student travel, uniformity of content, students can work on the class according to their own schedules (Hollis, Madill, 2006; Genc et al., 2016). Online students are more inclined to self-learning style, manifest themselves more independently and possess an internal locus of control, although findings regarding persistence in the distance classroom have been inconclusive (Gibson, 2003). The specificity of online learning is associated with a change in the characteristics of the social presence of the teacher and student in a learning situation (Richardson et al., 2017). It can be noted that character of student motivation in many ways determines the preference for students of the format of interaction with lecturer (direct or mediated via internet) and therefore allows more or less accurately predict the effectiveness of online education (Bassili, 2008; Markova et al., 2017). Research shows that students involved in online learning, often face the lack of possibility to interact individually with the teacher in real time and to receive timely feedback, tackle the lack of external control (Markova et al., 2017). Sometimes university students have a sense of isolation, which reduces satisfaction with teaching in groups of online education students (Richardson et al., 2017).

Previous research has shown that the motivation of students in the conditions of online learning differs depending on the education stage (Kim, Frick, 2011). At the beginning of online course, assuming self-development teaching materials, motivation of students is positively related to their technological competence and the extent to which they consider the course to be relevant to themselves (Kim, Frick, 2011). By the middle of the course, motivation is determined by understanding the meaning of the studied material for one's own education (Kim, Frick, 2011).

The present study is based on the Self-Determination Theory (Deci, Ryan, 1985), which has been used extensively to explore the structure of individual students' academic motivation and which highlights that all humans have an intrinsic need to be self-determining or autonomous (i.e., experience a sense of self-efficacy and control), as well as to feel competent (i.e., capable) and connected (i.e., included and linked to others) in relation to their environment (Ryan, Deci, 2000). Self-Determination Theory states that if environmental conditions support an individual's autonomy then more autonomous forms of motivation will be promoted (Ryan, Deci, 2000).

Satisfaction with personal competence or effectiveness can be a motivation to learn. Perceived competence can play an important role in shaping motivated behaviour and can be a major cause of motivated behaviour (Ryan, Deci, 2017). However, this is clearly not the case for all activities. Motivated behaviour is not limited to competence expectations – the individual needs additional rewards and satisfaction for motivated behaviour to be performed and maintained (Elliot et al., 2017). Thus, while competency-oriented theorists unequivocally argue that people tend to engage in actions in which they feel competent and avoid activities in which they lack competence, this does not adequately explain an individual's motivated behaviour. There are many examples of behaviour where a person is highly competent but has no personal interest or value in the activity performed. The element of behaviour – why a person chooses to do what he or she does – cannot be explained by focusing solely on competence. People by nature want to be independent – to interact voluntarily with the environment (the ability to choose so as to meet their needs) and to engage in activities that they find enjoyable (Ryan, Deci, 2017). Most creative, healthiest, and most productive achievements are achieved when we are motivated by an inner interest in the task (Ryan, Deci, 2017).

The Self-Determination Theory is unique because it distinguishes different types and subtypes of motivation and self-regulation. The value of these differences is supported by careful research based on the Self-Determination Theory, showing that different types of motives differently predict success, perseverance, and emotions in different achievements and competencies (Elliot et al., 2017).

Intrinsic motivation promotes activities in which the individual experiences inherent satisfaction; he or she finds this activity interesting and enjoyable (Ryan, Deci, 2017). In this sense, "rewards" are characteristic of activities, which activate areas of brain reward (Lee et al., 2012). Intrinsically motivated students do not need outside incentives. From a functional point of view, what activates intrinsically motivated students is pleasure, especially in terms of competence and autonomy (Lee et al., 2012). The factors, which hinder the realization of the needs of competence and autonomy, hinder intrinsic motivation (Lee et al., 2012). Thus, intrinsic motivation arises from self-awareness and from the pleasure which is felt during a particular activity (Morillo et al., 2018).

The concept of extrinsic motivation is the opposite of intrinsic motivation. It is related to instrumental motivation – it is the motivation related to external incentives and rewards to engage in activities. Extrinsic motivation is understood as a kind of potential reward (Morillo et al., 2018). "Students who are extrinsically motivated undertake activities for reasons separate from the activity itself (Ryan, Deci, 2000), for example gaining good grades, avoiding negative consequences, or because the task has utility value, such as passing a course in order to earn a degree" (Hartnett et al., 2011: 23).

According to Ryan and Deci (2017), if a teacher gives a reward to a student and the controlling aspect of the reward is considered dominant, then intrinsic motivation decreases, since the student will perceive the teacher to be externally manipulating his or her performance (Wighting et al., 2018). The degree to which an activity is perceived as externally controlled can vary, and therefore different types of extrinsic motivation exist. "This model conceptualises a continuum of regulation that ranges from amotivation (lack of motivation) at one end to intrinsic motivation at the other" (Hartnett et al., 2011: 23). The balance between extrinsic motivation and self-determined types of motivation becomes crucial in the context of online education (Hartnett et al., 2011).

The following research questions guided this study which is based on the Self-Determination Theory: 1) Does academic motivation differ in students of traditional and online education? 2) Are there gender differences in academic motivation levels in students of traditional and online education?

Study hypothesis – we hypothesize that online (distance) students possess stronger intrinsic motivation than traditional (in-classroom) students. Our hypothesis is based on students' studies (Rovai et al., 2007), which indicated that controlling environments (traditional, in-classroom) reduce a student's sense of autonomy and decrease intrinsic motivation.

The aim of the study was to determine the differences in academic motivation between university students of traditional (in-classroom) and online (distance) education.

The significance of research. This study makes a novel contribution to the literature, because the present study has compared academic motivation between university students of traditional and online education in a new context. i.e. before COVID-19 pandemic and during it. We also evaluated multiple aspects of academic motivation (three types of intrinsic motivation (intrinsic motivation to know, to accomplish things, and to experience stimulation), three types of extrinsic motivation (external, introjected, and identified regulation) and amotivation) in order to provide a comprehensive assessment of this phenomenon. We analysed academic motivation with respect to gender in the present study, because gender is among the important considerations in motivational functioning of students (Cerezo Rusillo, Casanova Arias, 2004).

2. Methods

Sample and Procedure. The random serial sampling method was used for this investigation. Study participants were recruited from a list of fifteen universities. The concerned universities were selected using simple random sampling as they were assessed in terms of the comparability of university size and their quality of students. The sample size recruited for the study before COVID-19 pandemic from the two universities was 194 traditional students and the sample size recruited for the study after COVID-19 pandemic from the two universities was 192 online students (online

classes have been organized using Zoom and MS Teams platforms). Study participants participated in the survey using a paper-pencil test before COVID-19 pandemic and by online survey during COVID-19 pandemic. Participants were informed that they may ask any questions or raise any concerns about the study. The total sample thus consisted of 386 students whose mean age at the start of the study was 19.21 years (SD = 0.83). There were no differences in age between traditional and online university students ($t(384) = 1.17$, n.s.). There were also no differences in age between male and female students ($t(384) = 1.26$, n.s.).

The study was approved by the Committee for Social Sciences Research Ethics of Lithuanian Sport University. The research was conducted in accordance with ethical guidelines and the legal code of the country in which the study was conducted. The questionnaire contained the instruments listed below.

Instruments. The Academic Motivation Scale (SAMS-21) by Kairys et al. (2017) was developed on the basis of the provisions of self-determination theory (Vallerand et al., 2008). This scale measures the seven subscales of motivation towards university studies. It contains 21 items assessed on a 7-point Likert type scale ranging from 1 (strongly disagree) to 5 (strongly agree). The SAMS-21 is subdivided into seven subscales which measures three types of intrinsic motivation (intrinsic motivation to know, to accomplish things, and to experience stimulation), three types of extrinsic motivation (external, introjected, and identified regulation) and amotivation. "Intrinsic motivation refers to doing something because it is inherently interesting or enjoyable, and extrinsic motivation refers to doing something because it leads to a separable outcome" (Ryan, Deci, 2000: 55). Extrinsic motivation refers to behaviour that is driven by external rewards such as money, fame, grades, and praise. External regulation is the type of extrinsic motivation, where individuals are responsive to threats of punishment or the offer of rewards and tend to be compliant as a result (Hartnett et al., 2011). It is the least autonomous type of external motivation.

Introjection refers to students who engage in a task because they act out of duty, to avoid feelings such as guilt and shame. Identified regulation is associated with individuals who engage in an activity because the results may have personal value to them or because the activity is regarded as worthwhile (Hartnett et al., 2011). According to Ryan and Deci (2000), amotivation is the state of lacking an intention to act. A high score for the subscale indicates strong type of motivation. The SAMS-21 shows good internal consistency. The value of the Cronbach's alpha coefficient for the present sample ranged from 0.63 to 0.87.

Statistical Analysis. Research data were statistically processed using SPSS 24.0 (Statistical Package for Social Sciences). Descriptive statistics, namely means, standard deviations, were calculated. Skewness (the symmetry of a distribution) and kurtosis (the homogeneity of a distribution) coefficients were calculated to assess univariate normality because Student t test requires normally distributed data. Skewness and kurtosis coefficients between +1 and -1 indicated that data were normally distributed. We calculated the reliability of each dimension given by the index of Cronbach's alpha internal consistence. Data analysis used the Student t test for independent samples, comparing traditional and online university students. Effect sizes were expressed as Cohen's d. Cohen's d effect sizes are generally defined as small (d = .2), medium (d = .5), and large (d = .8).

3. Results

Chi-square contingency table analysis revealed no differences in the demographic characteristics of the traditional and online university students based on gender, $\chi^2 (2, N = 386) = .16$, $p > .05$. In order to compare the types of academic motivation among traditional and online university students, the types' scores differences were determined using Student's *t*-test (Table 1).

Table 1. The statistical indicators of academic motivation among traditional and online university students (*M* ± *SD*)

Types of motivation	Traditional students (n = 194)	Online students (n = 192)	*t*-test score	Cohen's *d*
Intrinsic – To know	19.02 ± 4.31	19.93 ± 4.27	-2.08*	.21
Intrinsic – To accomplish things	18.03 ± 4.43	18.98 ± 5.01	-1.97*	.20
Intrinsic – To experience stimulation	17.27 ± 4.59	18.19 ± 4.56	-1.98*	.20
Extrinsic – Identified regulation	19.23 ± 5.22	19.77 ± 5.68	-.97	.10
Extrinsic – Introjected regulation	17.96 ± 4.63	18.09 ± 4.97	-.26	.03
Extrinsic – External regulation	17.38 ± 4.74	17.61 ± 4.54	-.49	05
Amotivation	07.11 ± 2.47	06.92 ± 2.61	.73	.07

Notes: (*M* ± *SD*) – mean and standard deviation; Cohen's *d* – effect size; * – $p < .05$.

It was found that online students' intrinsic motivation indicators levels were higher than those of traditional students. Statistical analyses revealed that online students reported greater scores in Intrinsic motivation – To know (t (384) = -2.08; $p < .05$), Intrinsic motivation – To accomplish things (t (384) = -1.97; $p < .05$), Intrinsic motivation – To experience stimulation (t (392) = -1.98; $p < .05$).

The results of the independent samples *t*-tests also were used to determine the differences between male and female university students. These results are summarised in Table 2. The independent samples *t*-test showed that there are no significant differences between male and female university students in all types of academic motivation.

Table 2. The statistical indicators of academic motivation male and female university students (*M* ± *SD*)

Types of motivation	Male students (n = 189)	Female students (n = 197)	*t*-test score	Cohen's *d*
Intrinsic – To know	19.11 ± 4.29	19.53 ± 4.33	-.96	.10
Intrinsic – To accomplish things	18.34 ± 4.75	18.98 ± 5.06	-1.28	.13
Intrinsic – To experience stimulation	17.81 ± 4.62	18.14 ± 4.54	-.71	.07
Extrinsic – Identified regulation	19.21 ± 5.47	19.76 ± 5.63	-.97	.10
Extrinsic – Introjected regulation	17.94 ± 4.68	18.12 ± 4.95	-.37	.04

Extrinsic – External regulation	17.36 ± 4.72	17.63 ± 4.58	-.57	.06
Amotivation	07.09 ± 2.53	06.91 ± 2.64	.68	.07

Notes: (*M* ± *SD*) – mean and standard deviation; Cohen's *d* – effect size; * – $p < .05$.

4. Discussion

The purpose of the present study was to investigate differences in academic motivation between university students of traditional and online education. This study revealed differences in intrinsic motivation between traditional and online university students. Our hypothesis that online students possess stronger intrinsic motivation than traditional students was confirmed. The current study has shown that online students' intrinsic motivation indicators levels were higher than those of traditional students (effect size was week, Cohen's *d* ranged from .20 to .21) – is in agreement with the data obtained by Rovai et al. (2007) that online students possess stronger intrinsic motivation than traditional students who attend face-to-face classes on three intrinsic motivation measures: to know, to accomplish things, and to experience stimulation (effect size was also week and varies from η_p^2 =.02 to η_p^2 = .04). Additionally, Fırat et al. (2018) supports that level of intrinsic motivation of distance education students is higher in e-learning environments.

The present research data may be explained by the Self-Determination Theory (Deci, Ryan, 1985), which emphasises that students whose behaviour is mostly internally regulated (or autonomous) have more interest, confidence, excitement, persistence, better performance, and show a better conceptual understanding of the material than students who are mostly externally controlled (Deci, Ryan, 2000). The current study findings suggest that course type could influence students' internally regulated (or autonomous) behaviour.

The results of our study reflect previous research, which has indicated that Self-Determination Theory has the potential to address learning problems such as student attrition in the online learning environment (Chen, Jang, 2010). In addition, study by Chen and Jang (Chen, Jang, 2010: 750) supported the Self-Determination Theory's main theorizing "that human motivation is a complicated, multidimensional inner process, as opposed to a singular, monolithic construct". In online education, students have different reasons to participate in class. "They may embrace internal reasons such as interest, joy, or the pursuit of self-fulfilment" (Chen, Jang, 2010: 750).

Continuing the discussion, we identified whether students' gender has a difference on academic motivation. Analyses indicated that there are no significant differences between male and female university students in all types of academic motivation. This finding was similar to the findings of Ramos and Habig (2019) whose showed that gender has no significant effect on academic motivation.

The results of the present study are also consistent with a study by Cerezo Rusillo and Casanova Arias (2004), showing that gender differences were not found in intrinsic motivation. This finding was not consistent with the findings of Bugler et al. (2013) in which girls were found to have significantly higher academic motivation than boys. In conclusion, our findings could be explained by the fact that Bugler et al. (2013) investigated academic motivation only in traditional (in-classroom) educational environment.

Limitations and future prospects. Our results were limited to university students. This analysis did not cover students of other educational institutions, and as a result, the conclusions cover only academic motivation of this particular group of students. The present study is a cross-sectional rather than experimental study, and the correlational nature of the study design makes it difficult to draw cause-and-effect conclusions, i.e., that course type (traditional and online) cause academic motivation. Longitudinal study design might be used in the future to examine academic motivation among traditional and online university students and to explore how indicators of academic motivation occur over time.

5. Conclusion

The study results revealed that students' intrinsic motivation scores were higher in online students than in students who attend traditional face-to-face classes. The results did not reveal significant differences between male and female students in terms of academic motivation.

References

Bassili, 2008 – *Bassili, J.N.* (2008). Motivation and Cognitive Strategies in the Choice to Attend Lectures or Watch Them Online. *Journal of Distance Education*. 22(3): 129-148.

Bates, 2005 – *Bates, A.W.* (2005). Technology, e-learning and distance education (2nd ed.). New York: Routledge Falmer.

Bugler et al., 2015 – *Bugler, M., McGeown, S. P., St Clair-Thompson, H. (*2015). Gender differences in adolescents' academic motivation and classroom behaviour. *Educational Psychology*. 35(5): 541-556.

Cerezo Rusillo, Casanova Arias, 2004 – *Cerezo Rusillo, M.T., Casanova Arias, P.F.* (2004). Gender differences in academic motivation of secondary school students. *Electronic Journal of Research in Educational Psychology*. 2(1): 97-112.

Chen, Jang, 2010 – *Chen, K.C., Jang, S.J.* (2010). Motivation in online learning: Testing a model of self-determination theory. *Computers in Human Behavior*. 26(4): 741-752.

Deci, Ryan, 1985 – *Deci, E.L., Ryan, R.M.* (1985). Intrinsic motivation and self-determination in human behavior. New York: Plenum Press.

Elliot et al., 2017 – *Elliot, A.J., Dweck, C.S., Yeager, D.S.* (2017). Handbook of competence and motivation: theory and application (2nd ed.). New York: The Guildford Press.

Fırat et al., 2018 – *Fırat, M., Kılınç, H., Yüzer, T.V.* (2018). Level of intrinsic motivation of distance education students in e-learning environments. *Journal of Computer Assisted Learning*. 34(1): 63-70.

Gallagher, McCormick, 1999 – *Gallagher, P.A., McCormick, K.* (1999). Student satisfaction with two-way interactive distance learning for delivery of early childhood special education coursework. *Journal of Special Education Technology*. 14(1): 32-47.

Genc et al., 2016 – *Genc, G., Kulusakli, E., Aydin, S.* (2016). A Comparative Study on the Motivation and Attitudes of Language Learners of Online Distance and Traditional In-Classroom Education. *Turkish Online Journal of Distance Education*. 17(4): 63-75.

Gibson, 2003 – *Gibson, C.C.* (2003). Learners and learning: The need for theory. In M.G. Moore & W. G. Anderson (Eds.). Handbook of distance education (pp. 147-160). Mahwah, NJ: Lawrence Erlbaum.

Hartnett et al., 2011 – *Hartnett, M., St. George, A., Dron, J.* (2011). Examining motivation in online distance learning environments: Complex, multifaceted and situation-dependent. *The International Review of Research in Open and Distributed Learning*. 12(6): 20-38.

Hollis, Madill, 2006 – *Hollis, V., Madill, H.* (2006). Online learning: The potential for occupational therapy education. *Occupational Therapy International*. 13(2): 61-78.

Kim, Frick, 2011 – *Kim, K.J., Frick, T.W.* (2011). Changes in student motivation during online learning. *Journal of Educational Computing Research*. 44(1): 1-23.

Lee et al., 2012 – *Lee, W., Reeve, J., Xue, Y., Xiong, J.* (2012). Neural differences between intrinsic reasons for doing versus extrinsic reasons for doing: An fMRI study. *Neuroscience Research*. 73(1): 68-72.

Markova et al., 2017 – *Markova, T., Glazkova, I., Zaborova, E.* (2017). Quality issues of online distance learning. *Procedia-Social and Behavioral Sciences*. 237: 685-691.

Morillo et al., 2018 – *Morillo, J.P., Reigal, R.E., Hernandez-Mendo, A.* (2018). Motivational Orientations, Autonomy Support, and Psychological Needs in Beach Handball. *Revista Internacional de Medicina y Ciencias de la Actividad Física y el Deporte*. 18(69): 103-117.

Ramos, Habig, 2019 – *Ramos, D.P.R., Habig, E.G.* (2019). Measuring the academic motivation of selected first year nursing students: a preliminary study. *International Journal of Education and Research*. 7(8): 173-182.

Richardson et al., 2017 – *Richardson, J.C., Maeda, Y., Lv, J., Caskurlu, S.* (2017). Social presence in relation to students' satisfaction and learning in the online environment: A meta-analysis. *Computers in Human Behavior*. 71: 402-417.

Rovai et al., 2007 – *Rovai, A., Ponton, M., Wighting, M., Baker, J.* (2007). A comparative analysis of student motivation in traditional classroom and e-learning courses. *International Journal on E-learning*. 6(3): 413-432.

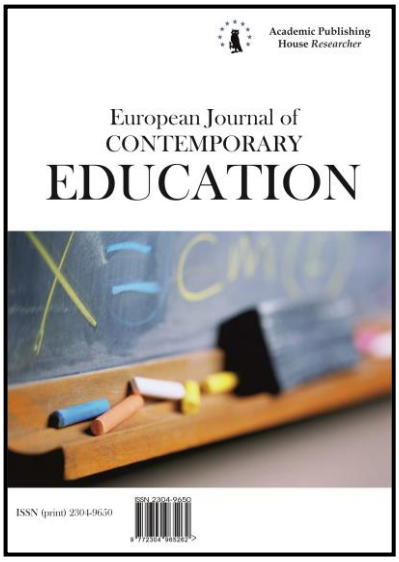
Ryan, Deci, 2000 – *Ryan, R.M., Deci, E.L.* (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology*. 25(1): 54-67.

Ryan, Deci, 2017 – *Ryan, R.M., Deci, E.L.* (2017). Self-Determination Theory. Basic Psychological Needs in Motivation, Development, and Wellness. NewYork: The Guilford Press.

Vallerand et al., 2008 – *Vallerand, R.J., Pelletier, L.G., Koestner, R.* (2008). Reflections on self-determination theory. *Canadian Psychology*. 49(3): 257-262.

Wighting et al., 2008 – *Wighting, M.J., Liu, J., Rovai, A.P.* (2008). Distinguishing sense of community and motivation characteristics between online and traditional college students. *Quarterly Review of Distance Education*. 9(3): 285-296.

Published in the Slovak Republic
European Journal of Contemporary Education
E-ISSN 2305-6746
2020, 9(3): 592-602
DOI: 10.13187/ejced.2020.3.592
www.ejournal1.com



A Case Study of Developing Research Competency in University Students

Alexander Yu. Prosekov [a], Irina S. Morozova [a, *], Elena V. Filatova [a]

[a] Kemerovo State University, Kemerovo, Russian Federation

Abstract

The research featured the measures required to plan scientific and research activities that develop research competency in university students. The authors explained the necessity to plan research activities in the way that would allow students to master educational and cognitive techniques and perform practical actions aimed at solving personal and socially significant tasks. The article outlines theoretical background of research work planning at institutions of higher education.

The concept of research competency was defined as a combination of motivational, gnoseological, operational, and personal components, developed at such a level that allows one to successfully apply the acquired research skills and knowledge in practical tasks. The authors believe that the development of research competency is the final result of education. Competencey as a new mental formation develops while mastering certain activities during the learning process. The phenomenon includes knowledge, skills, personality traits, and personal qualities. The paper introduces a set of criteria indicators that can be used to assess the level of research competence in students. The article also focuses on interactive methods, social media, and changing the role range of participants.

A set of experiments registered some positive changes in the parameters of the components that together make up research competency. The results revealed a higher level of motivation, which indicates that the students are growing more aware of the value of science and research. They also demonstrated a better-developed gnoseological component. This improvement can be explained by the fact that research work activated such cognitive processes as systematization, planning, comparison, and generalization. A higher development level of the operational and personal components was reflected in better quality research reports and scientific publications.

Keywords: research competency, education, professional training, students, components of research competency, criteria-based indicators of competency development.

* Corresponding author
E-mail addresses: ishmorozova@yandex.ru (I.S. Morozova), rector@kemsu.ru (A.Yu. Prosekov), filatova.fev@yandex.ru (E.V. Filatova)

1. Introduction

The domestic system of education is currently undergoing some changes in its organizational, substantive, and structural aspects. The changes are aimed at providing variability and personal orientation. The emerging education system requires a different attitude to the methods of obtaining knowledge by students, i.e. a new type of thinking. It is not enough anymore for students simply to learn prefabricated knowledge: students have to master the methods of scientific knowledge that will help them to acquire and apply knowledge by themselves by using traditional or novel ways and means.

The paradigm of the ultimate goal of education is changing as well: it is a competent professional and researcher with well-developed skills that make it possible to plan independent research activities. In this paper, research activity is an active, objective, logical, orienting, and integrating cognitive activity, which implies conscious and purposeful actions of students.

The main objective of the education system is to train competent and creative specialists that are able to plan their activities. According to N. Van den Berg, conventional skills are becoming less and less important, while non-standard and interdisciplinary skills are playing an increasingly important role (Van den Berg, 2017). The university graduate is a harmoniously developed specialist able to carry out various types of activities (Mustafa et al., 2019).

Let us consider the theoretical background of the research planning by university students. A. Obukhov defined the concept of research as a process of creative perception of the environment and oneself in the world (Obukhov, 1999). I.A. Zimnaya considered the research process as part of one's activity in the whole diversity of the informational environment. In this process, all the activities of the subjects are aimed at certain objects: without changing them, they are reflected by the objects and are then returned back to the subjects, but this time as knowledge about the objects (Zimnyaya, 2006).

Thus, research activity is an active form that contributes to the development of the individual psychological characteristics of the researcher. We consider the research process as a joint activity of an experienced researcher and a beginner. During their interaction, the latter expands his or her field of knowledge, thus producing new scientific knowledge.

The structure of research activity includes such elements as goal setting, motivation, research object, research methods, and efficiency. Research activities are aimed at acquiring new scientific knowledge, identifying new technological research methods, and achieving the research objective. Thus, research activity contributes to understanding the surrounding reality. When conducting research, it is important that this activity should be accepted by all its subjects, as this makes their actions more conscious, motivates them to meet the goal, and encourages their activity.

A. Leontovich interpreted the research activities of university students as a creative joint activity, where two subjects are looking for solution together. During the search, they exchange cultural values, thus shaping a worldview (Leontovich, 2003). This definition emphasizes that research process is a co-creativity of the student and the teacher in their search for a particular solution. This approach allows students to connect new knowledge with their own learning and thereby build links between content, activity, and technological tools (Tseng, Yeh, 2019). That is why the concept of research competence, or scientific-research competence, is a popular issue of various studies worldwide.

According to the systematic approach, this concept is considered as an integral part of professional competency and is considered as a component of its development (A.A. Derkach, T.A. Smolina V.A., L.A. Golub). The present research adheres to this point of view. V.N. Vvedensky characterized competence as a combination of such important qualities as critical thinking, mobility, and variability. These three qualities allow one to apply in practice the learned research skills and knowledge (Verbitsky, Larionova, 2009).

Scientific sources reveal two approaches to the definition of competency. In the first approach, competency is considered as a personal quality (A.K. Markova, B.G. Ananyev). The second defines competency as elements of human activity and the versatility of this activity, which allows one to solve various tasks (V.S. Lednev, V.N. Myasishchev, N.V. Kuzmina).

Therefore, this concept includes a set of definitions that characterize a person: personal characteristics; characteristics that reflect one's interaction with other people; characteristics that reflect the specifics of one's work performance.

Theoretical studies show that the development of research competency is the final result of education. Competency as a new mental formation develops while mastering certain activities during the learning process. The phenomenon includes knowledge, skills, personality traits, and personal qualities. According to C.P.M. van der Vleuten, the development of a skill means equal development of each of its components, while growth is defined as a monotonous process that results from training (Van der Vleuten, 1996). According to foreign studies, competencies are developed in the context of interdisciplinary training in problem situations (Stentoft, 2017), specially organized researches (Howard et al., 2013) and projects (Hamnett, Korb, 2017), research projects (Krajcik, Blumenfeld, 2006), a combination of full-time and online learning (Kintu et al., 2017), and a mixed educational environment (Geng et al., 2019).

Russian scientists have ambiguous views on research competence. A.A. Ushakov and I.I.Kholodtseva see it as an ability to navigate in non-standard and uncertain situations (Petrov, 2004). A.V. Khutorskiy, M.I. Gubanova, S.N. Chistyakova, and A.K. Markov interpret research competency as part of professional competency, depending on a particular area of activity (Khutorskoy, 2005).

Therefore, by developing research competency, we contribute to the professional development of the future specialist. In this paper, we consider the concept of research competency as one's ability to apply knowledge and skills in situations when a professional task has to be resolved in a scientific field. We distinguish several components in the structure of research competency.

Under the motivational component, we understand the following qualities: desire to solve the problem; conscious goal setting; ability to plan the necessary work. According to the modern motivational studies, internal motivation prevails over external motivation in people engaged in creative activity. This ratio indicates that people are involved in a variety of activities, because they like it, not because they pursue any tasks. Of course, such a division is conditional, since the internal motive comes from the person, while the external motive serves as a stimulus. E.V. Lesteva suggests considering a combination of primary and secondary motives. Primary motives are congenital. Secondary motives are predominant and acquired, e.g. motive of achievement, motive of power, etc. In scientific research, scientists recognize the priority of the achievement motive, i.e. desire to achieve the set objectives (Lesteva, 2009).

The essence of the gnoseological component is the knowledge system of the student. During research, the student should have ideas about the methodological apparatus, research methods, and methods of goal setting.

The operational component determines the qualities that are important during research. These qualities include the skill of conducting experiments and the ability to adjust one's actions to the changes that may occur during research.

The personal component defines the ability to analyze the obtained results, to conduct self-assessment, and to draw conclusions.

The components of research competency provide a better understanding of the research content and a better planning.

These components reflect the essential features by which this or that phenomenon is evaluated. Thus, we took some characteristics as indicators of the development of the research competency in university students.

When studying a research competence, it is important to define criteria and indicators of its development. A theoretical analysis revealed the fact that transitions to higher levels are associated with new characteristics that develop skills and expand knowledge. We distinguished three levels of research competency development in students: low, medium, and high (Table 1).

An analysis of scientific sources provided the fallowing definitions. We believe that the predominance of professional-axiological and cognitive motives in scientific and research activities can affect the development level of the motivational component. In the development of the operational and gnoseological components, priority belongs to the qualities of the personality of the students and the acquired research skills. While observing the development of research skills in students, we identified some specific characteristics of the skills.

We proceeded from the fact that the criteria indicators should combine standard features that make it easy to assess the level of development of research competence in students (Table 1).

Table 1. Levels of research competency development in students

Levels	Components			
	Motivational	Gnoseological	Operational	Personal
High	The students demonstrate an internal motivation for self-educational activity, which is reflected in their self-affirmation and self-expression; they are focused on the constant expansion of their knowledge and show high cognitive activity.	The students have knowledge of the main components of the methodological research apparatus; they know scientific methods and methodology of scientific research. Presentation of scientific materials is logical.	The students can organize their research process; they plan their own self-education using different forms and techniques; they are able to choose the sources of knowledge independently; they are able to transfer the acquired knowledge and skills into specific research circumstances. They can formulate the problem and research hypothesis, consolidate material, and draw conclusions.	The students display initiative in the search for research topics and involve others in the process during teamwork; they bear responsibility for their part of the research.
Medium	The students occasionally show interest in self-education, which is reflected in their self-affirmation and self-expression; they are focused on the constant expansion of their knowledge.	The students does not possess sufficient knowledge of the main components of the methodological research apparatus; they know some scientific methods and research methodology; they display occasional violations in the logic of presentation.	It is difficult for the students to organize research process, as well as self-education; they experience problems while transferring acquired knowledge and skills in research circumstances; it is hard for them to formulate the problem and hypothesis, as well as to consolidate materials and reports.	The students experience difficulties in taking the initiative in the search for research topics; they are passive in teamwork; they are unwilling to accept responsibility for their part of the research.
Low	The students show no desire for self-educational activities, self-affirmation, or knowledge expansion; the cognitive interest is low.	The students know neither methodological research apparatus nor scientific methods; the knowledge of research methodology is poor; there are serious violations in the logic of presentation.	The students can organize neither their research nor self-education; they fail to transfer the acquired knowledge and skills to research circumstances; they are unable to formulate the problem and hypothesis; they cannot consolidate information and draw conclusions.	The students are passive in determining the problems of scientific research, withdraw from teamwork, and do not accept responsibility for their part of the

				research.

This set of criteria-based indicators makes it possible to determine the qualitative changes in the development level of research competency in students during research work at a university.

2. Materials and methods

The present study featured the development level of research competency and its structural components in students of the Institute of Education, Kemerovo State University (Kemerovo, Russia). The empirical methods included polling and psychological testing. The experiment involved 74 first-year students of the Institute of Education.

To study the motivational component of research competency, we used the test of life-purpose orientations as adapted by D.A. Leontyev, as well as T. Ehlers' methods *Motivation for Success* and *Motivation Failure Avoidance*.

When studying the gnoseological component, we used the method of *Professional Readiness* by A.P. Chernyavskaya and the test *Readiness for Self-Development* by T.A. Ratanova and N.F. Shlyakhta.

The operational component was assessed with the help of such techniques as the questionnaire *Level of Subjective Control* by E.F. Bazhin, E.A. Golynkina, and A.M. Etkind and the questionnaire *Style of Self-Regulation of Behavior* by V.I. Morosanova.

The personal component was studied using T. Leary's *Diagnostics of Interpersonal Relationships*.

The quantitative and qualitative analysis involved methods of mathematical statistics (Student's t-test criterion for dependent samples). Statistica 6.0 software was used to check reliability of mathematical calculations.

The first-year students were divided into two groups: the experimental group consisted of 36 students majoring in Primary Education, while the control group consisted of 38 students majoring in Preschool Education. These groups were comparable: both groups majored in humanities, both curriculums presupposed advanced training according to similar programs. By the onset of the experiment, the students had had no serious experience in scientific research, since they start doing their first course projects during their third year. Therefore, the conditions for research competency development were equal in both groups, and they could undergo a comparative analysis. However, the conditions were slightly different at the opening phase of the experiment, since the experimental group had one discipline too many.

The opening phase of the experiment involved a set of measures to plan scientific and research activities, adjustment of methods and techniques of training, and definition of the effectiveness of students' personal advancement. The students of the experimental group were engaged in the work of the Young Researcher Association and followed the course of *Organization of Scientific Research*. They participated in a variety of research activities. The activity aimed at the formation of research competency was tested for qualitative changes in cognitive processes and personal characteristics, which were reflected in a more sophisticated reproduction of the surrounding world and more complicated human activities.

This idea was based on student-led research projects carried out in various European universities. The so-called flipped classroom technology seems especially effective: students watch e-videos, study additional sources on their own outside the classroom, and then discuss new concepts and their prospective implementation with the teacher in class (Marín et al., 2018).

There are technologies for attracting social media to the university class (Chawinga, 2017) and systematic cooperation with students and professors from other universities (Arruabarrena et al., 2019). During the experimental work, we tested the game *How to Fail Your Research*, which combined constructivist and experimental strategies (Abbott, 2019).

These technologies ensured the development of research competency in situations when the subject experienced a change in the internal content of the personality. The driving force in this process of self-improvement is the contradictory nature of the existing and desirable level of research competence.

3. Results

At the ascertaining stage of the experiment, the students were questioned in order to identify the initial available level of research competency. The polling revealed information about their attitude to participation in scientific events, and the difficulties they encounter when planning their own scientific and research activities. The questions required complete answers. The questionnaire included a list of alternating open questions that suggested a free answer and closed questions that suggested one possible answer.

92 % of the respondents answered positively to the question *Should students of vocational education institutions do research work?* However, only 54 % gave a positive answer to the question *Would you like to take part in research work?*

When answering the question *Where can you use the results obtained in the course of scientific and research work?*, 88 % of the respondents mentioned nothing but thesis or term projects, which indicates that the students were unaware of the various forms of this type of activity.

The responses to the question *What can motivate you to participate in scientific and research work?* revealed various priorities: to obtain moral good (2.5 %), to obtain knowledge in a particular area that will be useful for further education (4.5 %), for self-expression or self-affirmation (17.5 %), out of interest for this type of activity (22 %), to obtain knowledge that will be necessary in future professional activities (24.5 %), to fulfill the requirements stated in the curriculum (29 %).

As for the question about the difficulties in the scientific and research work, most difficulties appeared to be associated with the inability to state the research problem (14 %), to solve the planned tasks (30 %), to formulate the research apparatus (26 %), to structure and summarize the obtained results (14 %), and to plan the research (16 %).

The polling revealed the lack of knowledge about what constitutes research process, despite the fact that the first-year disciplines have a great potential for organizing research activities. A more thorough study of the responses and personal meetings with the students made it possible to specify the difficulties. On the one hand, the students felt that at school they had not acquired enough knowledge and skills to be able to participate in research. On the other hand, they did not participate in the activities of the young researchers' community.

The obtained data highlighted the problem of purposeful organization of the process of preparing students for research work. We believe that it is necessary not only to inform students about the nature of scientific research work and its effectiveness, but also to develop personal characteristics and skills that are necessary to conduct research. When implementing the set of measures, we took into account the sequence of practical steps: motivating students to be engaged in research activities, initial familiarization with the basic concepts of research work; systematization of ideas about the essence of scientific and research activities; using the knowledge and skills acquired during training to solve research tasks.

We analyzed the content of the components of students' research competency in the reference set to test the developed measures for effectiveness. The results obtained made it possible to split the students into the control and experimental groups. Table 2 shows the mean values of the experimental and control groups before the experiment.

Table 2. Content of the components of students' research competence: mean values at the opening stage of the experiment

Indicator	Mean values		t-criterion	Significance level of the differences (p)
	Experimental group	Control group		
Motivation component				
Motivation for avoiding failures	18.08	18.02	0.33	0.7
Result	25.20	25.18	0.09	0.93
Gnoseological component				
Knowledge acquisition	5.76	5.72	0.86	0.4
Acquiring skills	2.36	2.33	0.81	0.43
Planning	14.50	14.48	0.86	0.4

Goal	27.92	27.90	0.84	0.41
Result	22.21	22.23	-0.08	0.94
Operational component				
General internality	29.26	29.30	-0.26	0.79
Internality in the field of achievements	5.71	5.75	- 0.86	0.4
Internality in the field of interpersonal relations	6.00	6.16	-1.18	0.26
Decision making	12.56	12.05	0.99	0.33
Personality component				
Awareness,	9.06	9.10	-0.33	0.7
Emotional Attitude	11.93	11.70	0.99	0.33
Empathy	49.06	49.46	-1.4	0.17

We compared the groups according to Student's t-test for independent samples to prove that they were statistically equal. The comparative analysis confirmed that the content characteristics of the research competency components in the experimental group did not exceed the results obtained from the control group at the opening phase.

At the first stage of the formative influence, the most important tasks were associated with the initial research skills and the expansion of existing knowledge about research process.

At the second stage, the task was to shape the knowledge of research methodology and learn to apply this knowledge and skills to research work, e.g. scientific articles, reports, research projects, abstracts, etc.

When introducing students to scientific and research activities, we observed the sequence of stages of activity: from interest to motivation, and then to practical actions. The stages considered above were integrated; they did not exclude each other, and their objectives continued to be addressed in further research.

Table 3 shows the data obtained at the final stage of the experiment in the control and experimental groups. The results revealed positive dynamics of those content characteristics of students' research competency that were involved in the developed set of measures.

Table 3. Mean values of the content characteristics of the components of research competence in students at the final stage of the experiment

Indicator	Mean values		t-criterium	Significance level of the differences(p)
	Experimental group	Control group		
Motivational component				
Motivation for avoiding failures	14.52	18.10	-3.05	0.00
Reault	28.88	25.22	2.41	0.02
Gnoseological component				
Acquisition of knowledge	8.20	5.75	2.17	0.04
Acquiring skills	5.27	2.37	3.12	0.01
Planning	18.73	14.52	2.41	0.02
Goal	33.10	27.94	2.16	0.04
Result	29.73	22.26	2.28	0.03
Operational component				
General internality	34.00	29.26	2.17	0.04
Internality in the field of achievements	9.14	5.73	2.25	0.03
Internality in the field of interpersonal relations	6.86	6.02	2.16	0.04
Decision making	14.60	12.58	2.39	0.02
Personality component				
Awareness	11.26	9.08	2.70	0.01
Emotional attitude	18.20	11.96	4.51	0.00
Empathy	52.46	49.08	2.17	0.04

The table clearly shows positive changes in the level of content characteristics of the motivational component of the research competence in the experimental group. The mean values for this component in the control and experimental groups demonstrated significant differences at the final stage of the experiment. The indicator *Motivation for Avoiding Failures* demonstrated statistically significant differences, i.e. young researchers from the experimental group stopped searching for external causes of their own failures and reoriented themselves to success ($t = -3.05$, variance = 72 at $p < 0.01$). The indicator *Result* also showed statistically significant difference, which means that the experimental group was satisfied with the achievements they had during the training period ($t = 2.41$, variance = 72 at $p < 0.05$).

The mean values of the content characteristics of the gnoseological component demonstrated significant differences between the results obtained from the control and experimental groups at the final stage. Statistically significant differences of the *Knowledge Acquisition* indicator may indicate that the students from the experimental group accumulated more knowledge about research methods than those from the control group and improved their professional competencies during classes ($t = 2.17$, variance = 72 at $p < 0.05$). Statistically significant differences for the indicator *Acquiring Skills* proved that students from the experimental group gained some research experience ($t = 3.12$, variance = 72 at $p < 0.05$). Other three indicators also demonstrated statistically significant differences: *Planning* ($t = 2.41$, variance = 72 at $p < 0.05$), *Goal* ($t = 2.16$, variance = at $p < 0.05$), and *Result* ($t = 2.28$, variance = 72 at $p < 0.05$). Apparently, the experimental group students mastered several methods that allowed them to achieve their goals. They had a greater willingness to make efforts to fulfill tasks and achieve the set goals.

The mean values of the content characteristics of the operational component also showed significant differences between the results obtained from the control and experimental groups at the final stage: *General Internality* (GI) ($t = 2.17$, variance = 72 at $p < 0.05$), *Internality in the field of achievements* (IA) ($t = 2.25$, variance = 72 at $p < 0.05$), and *Internality in the field of Interpersonal Relations* (IIR) ($t = 2.16$, variance = 72 at $p < 0.05$). The results indicate that the students engaged in scientific activities tended to consider themselves responsible for what was happening to them (GI), including the spheres of goal achievement (IA) and interpersonal interaction (IIR). The indicator of *Decision Making* also revealed significant differences ($t = 2.39$, variance = 72 at $p < 0.05$), which means that the experimental group students developed autonomy and independence in decision making, especially in the professional sphere. They also proved to possess a greater willingness to bear responsibility for the consequences of their own decisions.

The mean values of the content characteristics of the personality component also showed significant differences between the results obtained from the control and experimental groups at the final stage: *Awareness* ($t = 2.70$, variance = 72 at $p < 0.05$), *Emotional Attitude* ($t = 4.51$, variance = 72 at $p < 0.01$), and *Empathy* ($t = 2.17$, variance = 72 at $p < 0.05$). The *Awareness* indicator characterized the level of awareness of the specifics of the activity the student was performing. Its improvement may indicate sufficient awareness of the options for professional development. The improved indicator of *Emotional Attitude* is likely to reflect a positive emotional attitude towards the process of learning and career planning. The *Empathy* indicator increased, which denotes that the students grew more sensitive to the needs and problems of other people.

4. Discussion

The data obtained made it possible to analyze the development level of the content characteristics of the research competency components.

To build up research competence in students, it is not enough to teach them basic techniques and methods. They should get acquainted with the work of practicing researches, including the kind of studies they conduct together with students. One way to involve practicing scientists into students' research would be to invite them to classes to demonstrate the main methods and techniques related to problem-based learning or to conduct mini-studies. In other words, teaching staff must provide proper conditions for the acquisition of research experience.

The data obtained are comparable with the results published by C.H. Chena and Y.C. Yang: project-based learning has a more positive effect on student performance compared to traditional learning (Chen, 2019).

In this research, we used productive forms of inclusive participation in various activities of the student research community. As a result, we managed to increase the motivation of students to

participate in scientific research activities. They recognized the value of team work and team support by working in better conditions for further personal self-improvement. Students realized the practical meaning of scientific research, thus learning how to use their intellectual work in satisfying a particular need.

The results clearly show positive changes in the level of motivation, which indicates that the students grew more aware of the value of scientific research. This fact is comparable with the results we obtained in our previous research regarding the subjective position of subjects of education process (Prosekov et al., 2020). Our position is consistent with the research conducted by F. Trede and D. Jackson, who assessed the stage of involvement in the formation of conscious professionals (Trede, 2019).

In addition, the analysis revealed a higher level of formation of the gnoseological component. This must have been associated with the activation of cognitive processes during research, i.e. systematization, planning, comparison, generalization.

The evidence of positive changes in the level of gnoseological component formation is similar with the results obtained by Z. E. Davidson and C. Palermo, who described the development of students' research skills, e.g. their ability to collect, process, and evaluate information, work independently, and think critically (Davidson, Palermo, 2015).

The experimental group showed a better development of operational and personal components. The progress was reflected in students' research reports that summarized their scientific projects for publications. These results are consistent with those obtained by A. García-Aracil, S. Monteiro, and L.S. Almeida, who studied how students accepted a multidimensional perspective of their own academic experience. Extensive academic experience proved to have a positive effect on students' perceptions of their readiness for professional activities (García-Aracil, 2018).

The experimental group demonstrated a faster and more productive development of research competency than the control group.

5. Conclusion

The theoretical analysis of the problem and the experimental studies proved that the development of research competency can be considered from three different angles:

- as one of the areas of pedagogical science that studies the laws of development and formation of the specialist in order to develop stages, content, forms, and methods of professional education (scientific aspect);
- as methodological support for the entire process of education, e.g. compiling curriculums and didactic materials, teacher training, etc. (applied aspect);
- as a direct professional activity of teachers of professional educational institutions (practical aspect).

Each of the proposed aspects has its own tasks, and their solutions require specific training.

The scientific aspect involves the theoretical justification and development of teaching methods. While academic studies only identify certain laws and thereby expand scientific knowledge, this kind of studies also determines the pedagogical conditions for the implementation of laws in the context of the personality development of the future professional.

The applied aspect involves the use of pedagogical and methodological knowledge by teachers that are willing to apply and assimilate the latest scientific data in planning and implementation of education programs.

The practical aspect is provided by the teachers themselves, whose task is to use everything that the contemporary pedagogical science has to offer. The success of their activities depends on their professionalism.

The development of applied and practical aspects relies on the scientific aspect, the latter being the theoretical basis that helps to define goals, stages, methods, and content of the development of research competence.

To facilitate the development of research competency in students, we identified criteria that can be used to evaluate the content characteristics of the components. As a result, we defined three levels of competence development.

In the classroom, students were engaged in research work by solving problem tasks, doing practical work, writing course papers, doing individual and team projects, on-the-job training, industry-based final year projects, etc.

During extracurricular activities organized by the association of young researchers, students took part in research events of various levels, e.g. scientific and practical conferences, festivals, competitions, seminars, round tables, discussion platforms, etc.

During the opening phase, the students were motivated to get involved into scientific and research activities. They also acquired basic information about research planning.

During the main phase of the study, the students acquired theoretical ideas about the research process. They had to solve some practical tasks and apply their knowledge about planning and conducting research activities.

The experiment revealed positive changes in the parameters of components of the research competency. The motivation of the students in the experimental group improved significantly, which means that they grew aware of the value of scientific and research activities. The development level of the gnoseological component also improved. This means that the research activities triggered such cognitive processes as systematization, planning, comparison, and generalization. The good quality of their reports signified a better development level of the operational and personal components.

In general, the present research demonstrated opportunities for increasing the productivity of the scientific and research activities of students participating in the work of the young researchers' association.

References

Abbott, 2019 – *Abbott D.* (2019). Game-based learning for postgraduates: an empirical study of an educational game to teach research skills. *Higher Education Pedagogies*. 4(1): 80-104.

Arruabarrena et al., 2019 – *Arruabarrena, R, Sánchez, A., Blanco, J. M., Vadillo, J.A., Usandizaga, I.* (2019). Integration of good practices of active methodologies with the reuse of student-generated content. *International Journal of Educational Technology in Higher Education*. 16: 10. DOI: https://doi.org/10.1186/s41239-019-0140-7

Chawinga, 2017 – *Chawinga, W.D.* (2017). Taking social media to a university classroom: teaching and learning using Twitter and blogs. *International Journal of Educational Technology in Higher Education*. 14: 3. DOI: 10.1186/s41239-017-0041-6

Chen, 2019 – *Chen, C.H., Yang, Y.C.* (2019). Revisiting the effects of project-based learning on students' academic achievement: A meta-analysis investigating moderators. *Educational Research Review*. 26: 71-81.

Davidson, Palermo, 2015 – *Davidson, Z.E., Palermo, C.* (2015). Developing Research Competence in Undergraduate Students through Hands on Learning. *Journal of Biomedical Education*, 9. DOI: 10.1155/2015/306380

García-Aracil et al., 2018 – *García-Aracil, A., Monteiro, S., Almeida, L.S.* (2018). Students' perceptions of their preparedness for transition to work after graduation. *Active Learning in Higher Education*. DOI: https://doi.org/10.1177/1469787418791026

Geng et al., 2019 – *Geng, S., Law, K.M.Y., Niu, B.* (2019). Investigating self-directed learning and technology readiness in blending learning environment. *International Journal of Educational Technology in Higher Education*. 16: 17.

Hamnett, Korb, 2017 – *Hamnett, H., Korb, A.* (2017). The coffee project revisited: Teaching research skills to Forensic chemists. *Journal of Chemical Education*. 94(4): 445-450. DOI: 10.1021/acs.jchemed.6b00600

Howard et al., 2013 – *Howard, J., Ferguson, M., Wilkinson, P., Campbell, K.L.* (2013). Involvement in research activities and factors influencing research capacity among dietitians. *Journal of Human Nutrition and Dietetics*. 26(1): 180-187.

Khutorskoy, 2005 – *Khutorskoy, A.V.* (2005). Metodika lichnostno-orientirovannogo obucheniya. Kak obuchat' vsekh po-raznomu? [The methodology of personality-oriented learning. How to train everyone differently?]. M.: Vlados-Press. 383 p. [in Russian]

Kintu et al., 2017 – *Kintu, M.J., Zhu, C., Kagambe, E.* (2017). Blended learning effectiveness: the relationship between student characteristics, design features and outcomes. *International Journal of Educational Technology in Higher Education*. 14: 7. DOI: 10.1186/s41239-017-0043-4

Krajcik, Blumenfeld, 2006 – *Krajcik, J.S., Blumenfeld, P.* (2006). Project-based learning. In R.K. Sawyer (Ed.). *The Cambridge Handbook of the Learning Sciences:* 317-334. New York, NY: Cambridge University Press.

Leontovich, 2003 – *Leontovich, A.V.* (2003). Proektirovanie issledovatel'skoi deyatel'nosti uchashchikhsya: [Planning the research activities of students]: Avtoref. diss. ... kand. psikhol. nauk. M. 27 p. [in Russian]

Lesteva, 2009 – *Lesteva, E.V.* (2009). Pedagogicheskoe soprovozhdenie issledovatel'skoi deyatel'nosti uchashchikhsya v protsesse prepodavaniya gumanitarnykh distsiplin [Pedagogical support of students' research activities in the process of teaching humanities]: dis. ... kand. ped. nauk. Smolensk. 202 p. [in Russian]

Marín et al., 2018 – *Marín, V.I., Duart, J.M., Galvis, A.H., Zawacki-Richter, O.* (2018). Thematic analysis of the international journal of educational Technology in Higher Education (ETHE) between 2004 and 2017. *International Journal of Educational Technology in Higher Education*. 15: 8. DOI: 10.1186/s41239-018-0089-y

Mustafa et al., 2019 – *Mustafa, E., Mohd Ariffin, N., Mohd Arshad, A.H., Mohamad, A.M., Hanafiah, N.A.H.* (2019). Roles of Higher Education Institutions (HEIs) in Producing Holistic Graduates. *International Journal of Education, Psychology and Counseling*. 4(32): 29-42. DOI: 10.35631/IJEPC.432004

Obukhov, 1999 – *Obukhov, A.N.* (1999). Issledovatel'skaya deyatel'nost' kak sposob formirovaniya mirovozzreniya [Research activity as a way of shaping a worldview]. *Narodnoe obrazovanie*. 10: 158-161. [in Russian]

Petrov, 2004 – *Petrov, A.A.* (2004). Professional'naya kompetentnost': ponyatiino-terminologicheskie problemy [Professional competence: conceptual and terminological problems]. *Vestnik vysshei shkoly*. 10: 6-11. [in Russian]

Prosekov, 2020 – *Prosekov, A.Yu., Morozova, I.S., Filatova, E.V.* (2020). A Case Study of Graduate Quality: Subjective Opinions of Participants in the Sphere of Education. *European Journal of Contemporary Education*. 9(1): 114-125. DOI: https://doi.org/10.13187/ejced.2020.1.114

Stentoft, 2017 – *Stentoft, D.* (2017). From saying to doing interdisciplinary learning: Is problem-based learning the answer? *Active learning in Higher Education*. 1: 51-61.

Trede, 2019 – *Trede, F., Jackson, D.* (2019). Educating the deliberate professional and enhancing professional agency through peer reflection of work-integrated learning. *Active Learning in Higher Education*. DOI: https://doi.org/10.1177/1469787419869125

Tseng, Yeh, 2019 – *Tseng, S.-S., Yeh, H.-C.* (2019). Fostering EFL teachers' CALL Competencies Through Project-based Learning. *Educational Technology & Society*. 22(1): 94-105.

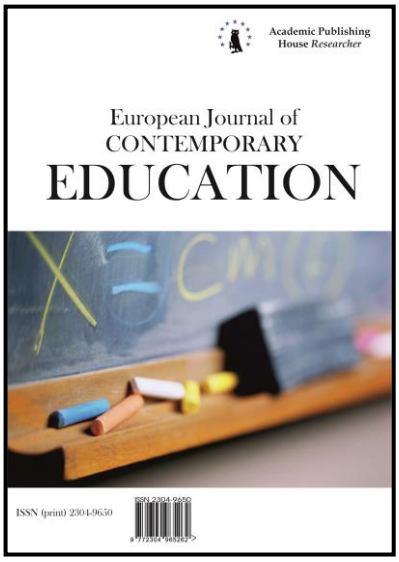
Van den Berg, 2017 – *Van den Berg, N.* (2017). Boundary-crossing competences of educators and researchers in working on educational issues. *Journal of Finnish universities of applied sciences*. [Electronic resource]. URL: https://uasjournal.fi/in-english/boundary-crossing-competences-of-educators-and-researchers-in-working-on-educational-issues1/

Van der Vleuten, 1996 – *Van der Vleuten, C.P.M.* (1996). The assessment of professional competence: developments, research and practical implications. *Advances in Health Sciences Education*. 1(1): 41-67.

Verbitsky, Larionova, 2009 – *Verbitsky, A.A., Larionova, O.G.* (2009). Lichnostnyi i kompetentnostnyi podkhody v obrazovanii: problemy integratsii [Personal and competency-based approaches in education: problems of integration]. M.: Logos. 336 p. [in Russian]

Zimnyaya, 2006 – *Zimnyaya, I.A.* (2006). Kompetentnostnyi podkhod. Kakovo ego mesto v sisteme sovremennykh podkhodov k probleme obrazovaniya? (teoretiko-metodologicheskii aspekt) [Competency-based approach. What is its place in the system of modern approaches to the problem of education? (theoretical and methodological aspect)]. *Vysshee obrazovanie segodnya*. 4: 20-27. [in Russian]

Published in the Slovak Republic
European Journal of Contemporary Education
E-ISSN 2305-6746
2020, 9(3): 603-620
DOI: 10.13187/ejced.2020.3.603
www.ejournal1.com



Professional Self-Determination Support for Students in the Digital Educational Space

Elena V. Soboleva [a, *], Tatyana N. Suvorova [a], Svetlana V. Zenkina [b], Mikhail I. Bocharov [c]

[a] Vyatka State University, Kirov, Russian Federation
[b] Academy of Social Management, Moscow, Russian Federation
[c] Financial University under the Government of the Russian Federation (Financial University), Moscow, Russian Federation

Abstract

The problem that the study is aimed at is due to the need to change forms and methods of professional self-determination support for students in the digital society in order to prepare them for obtaining the specialization that is in demand and for the formation of the ability “to be able to learn" throughout the life.

The purpose of the study is to theoretically justify and experimentally verify the effectiveness of the use of digital technologies for professional self-determination support for students in the modern educational space.

The research methodology consists of the theoretical analysis of foreign and domestic approaches to career guidance, the comparison of digital resources for navigating professions of the future, the differential diagnostic questionnaire, additional questionnaires, methods of mathematical statistics, and the student self-assessment method. The pedagogical experiment was carried out in two directions: the qualitative assessment of changes in students' professional preferences and the analysis of the results of career guidance activities supported by digital technologies, regarding the development of personal qualities in demand.

The results of the study. The necessity of taking into account the organization of career guidance activities in two directions is justified: informing students about the professions in demand, the needs and priorities of the digital society, as well as the formation of the competence of professional self-determination. The potential of digital technologies for each of the selected areas is described. The authors developed the virtual assistant model to implement the identified

* Corresponding author
E-mail addresses: sobolevaelv@yandex.ru (E.V. Soboleva), tn_suvorova@vyatsu.ru (T.N. Suvorova), Svetlana_zenkina@mail.ru (S.V. Zenkina), mi1@mail.ru (M.I. Bocharov)

didactic possibilities. The system of work with the virtual assistant is presented for professional self-determination support for students and for building the personal development path.

In conclusion the summary is given, confirming that the use of the virtual assistant in career guidance in the digital school will increase the effectiveness of preparing students for the conscious choice of the future profession in demand, the formation of cognitive abilities that form the basis of the ability "to be able to learn".

Keywords: digital technologies, career guidance, career path, intellectual qualities, professional competence, educational space, virtual assistant, challenges of the future.

1. Introduction

1.1. Relevance of the problem

Modern society has entered a new era – the era of transformation, which implies the creation of the digital space that adapts to information and social technologies, the requirements of customer-focusedness and competitiveness, and the challenges of the economy of the future. The "Strategy for the development of the information technology industry in the Russian Federation for 2014–2020 and for the long term to 2025" (Strategiya razvitiya..., 2017) defines the directions of development of the digital economy taking into account global trends in globalization and automation. To implement these areas in practice key demanded universal competences for each economic sector were specified in the Atlas of new professions (Nadprofessional'nye navyki). In particular, it is indicated that in the society, under the influence of digital transformation, there will be a reduction in professions where the person is required to perform routine monotonous work (sorter, storekeeper, accountant, seller) (Gurtov, Hoteeva, 2018). The greatest demand among employers will be specialists who can independently master related sectors, perform various functions in teamwork, and forecast decision-making in conditions of uncertainty (Ganseuer et al., 2015). All of these characteristics form the basis of the individual's intellectual competence. The training of "new" specialists who have appropriate qualities requires the digital educational space at all levels from pre-school education to courses of advanced studies for the introduction of innovative teaching ideas.

At present most domestic and foreign researchers point out the discrepancy between the requirements of employers, the demands of the state and business with the real competences of graduates (Varshavskaya, Kotyrlo, 2019). Motivational, psychological, socio-economic, and technical factors are noted as the reasons for this (Zhurkina et al., 2016). However, the leading role of the teacher who support the student's professional self-determination is recognized unchanged (Sidelnikova, 2018).

The teacher in the modern educational space should become a curator who will help develop the individual path of professional development, will orient students in accordance with their chosen priorities (Soboleva et al., 2018). Support for students to choose the future profession in demand in accordance with their abilities and capabilities, and, therefore, support for the formation of intellectual competence, largely depends on the quality of timely information, on cognitive experience.

To increase the effectiveness of professional orientation and designing the career path, modern digital technologies can and should be used. However, their potential in the educational environment is used primarily to inform students about professions, vacancies, and opportunities to continue education (Atlas of the professions of the future; HeadHunter). In some cases, a digital resource is used for diagnostics (Navigatum), testing, questionnaires (Testometrika). At the same time, the functionality of digital technologies also has tools that allow forming competences of professional self-determination, mastering the methods of mental activity, and developing general intellectual skills (Kholodnaya, Gelfman, 2016).

1.2. Aims and objectives of the research

The aim of the research is due to the need to change the forms of professional self-determination support for students in the context of new requirements of the digital society and the capabilities of modern software tools to prepare them not only for profession in demand, but also for the development of the ability "to be able to learn" throughout the life.

The objectives of the research:

– to justify the need for changes of forms and methods of career guidance taking into account the priorities of the digital economy;

– to investigate the innovative experience of specialists who are competent in the field of designing the personal career path;

– to formulate ideas that determine the functionality of the digital resource to support the formation of the competence of professional self-determination, mastering methods of mental processes, general intellectual skills;

– to implement functionality on the example of the specific virtual assistant;

– to experimentally verify the effectiveness of the proposed changes in two directions: to assess changes in professional preferences and the formation of the competence of professional self-determination, taking into account the intellectual capabilities of the individual.

2. Relevance

2.1. Literature review

2.1.1. Analysis of Russian scientific and pedagogical literature

Fundamental scientific works devoted to the study of the peculiarities of career guidance in Russia and the innovative experience of teachers were analyzed to confirm the need for changing the orientation of career guidance in the educational space and the need to include digital resources in the design of the future career path of the individual.

It should be noted that numerous studies are being carried out with the aim of clarifying such concepts as “professional orientation”, “professional self-determination”, “professional preferences”, “professions of the future”, “over-professional competences”, and “personal career path”. Let us single out the works of N.S. Pryazhnikov (Pryazhnikov, 2008), O.A. Kolesnikova, A.M. Doneckij (Kolesnikova, Doneckij, 2016), A.Ya. Zhurkina, E.G. Sergushina, O.V. Sergushina (Zhurkina et al., 2016), I.G. Dezhina, G.A. Klyucharyov (Dezhina, Klyucharyov, 2018), which summarize various approaches to the organization of career guidance activities, justify the need to improve forms of career guidance for the preparation of graduates that meet the requirements of the labor market in the conditions of priorities of the digital economy. These studies are due to the fact that the professionalization of the individual is an essential part of socialization; it ensures the continuity of generations, the development of the institutions of the family, education, and labor market (Klochkov et al., 2017). According to V.A. Gurtov, E.A. Hoteeva, sustainable professionalism and competence is characterized by the high quality human capital, which determines the development of the country as a (Gurtov, Hoteeva, 2018). The authors substantiate that traditional forms of building the career path are becoming ineffective in the context of new requirements of the market and the digital economy. V.A. Gurtov, E.A. Hoteeva distinguish the following characteristic of modern practice of career guidance as one of the reasons for the imbalance between the requirements of employers and the real competences of students: the choice of the specialty by the individual is most often based on emotional attractiveness and success when studying school subjects. The global digital transformation has had a significant impact on the needs of society, business, and the state regarding professions that will be in demand in the future. In reality, schools and universities prepare graduates without taking into account the trends of long-term planning, globalization and competitiveness. Many of the graduates are generally unaware of the new professions of the digital economy. Significance of the noted work V.A. Gurtov, E.A. Hoteeva is that they suggest using information resources (for example, the portal “My Career”) to support professional self-determination of the student’s personality (Gurtov, Hoteeva, 2018). While on the subject of informing students about the professions of the future, we turn to the conclusions of E. Varshavskaya, E. Kotyrlo. According to experts, most of modern graduates do not have a clear understanding of the content of future professional activities, there is no idea about the development of the career path (Varshavskaya, Kotyrlo, 2019).

Another fundamental research in the problem area was carried out by A.V. Korolenko, O.N. Kalachikova (Korolenko, Kalachikova, 2016). The scientists conducted a detailed analysis of the formation of professional preferences among teenage schoolchildren and its impact on the timely mastering of social roles in the digital society. A.V. Korolenko, O.N. Kalachikova noted that "the key problem is the lack of knowledge of the basic requirements for the profession, their own

psychophysiological capabilities, as well as the inability to compare their preferences with real abilities."

Their findings are confirmed by the results of diagnostic surveys, questionnaires, and focus group studies. An important result of the work is that the peculiarities of building students' educational paths (motives, awareness, abilities, self-esteem, preferences) are analyzed. A separate aspect highlights students' understanding of their qualities and skills that will help in mastering their chosen profession, and be competitive in the labor market. The theme of competitiveness as an important condition for preparing students for career planning is continued by G.F. Shafranov-Kucev, L.V. Gulyaeva (Shafranov-Kucev, Gulyaeva, 2019). The most significant for the study is the conclusion of scientists that "the ability to reproduce knowledge when implementing future activities, readiness for constant self-development, and orientation toward the search for new ways to solve problems" should determine the directions of professional self-determination support for the individual. The authors also examine the factors that determine students' choice of future specialization (inclinations, interests, life values, prospects, initiative, sociability). Summarizing the results obtained by G.F. Shafranov-Kucev, L.V. Gulyaeva, it should be emphasized that they actively use the term "competence of professional self-determination", taking into account the intellectual capabilities and educational interests of the personality of the student. This competence can and should be fromed in the modern educational space (Shafranov-Kucev, Gulyaeva, 2019).

More practical problems are solved in the study of I.V. Ivanova, N.G. Ivanov (Ivanova, Ivanov, 2019). The authors proposed a model for interaction of educational organizations at various levels of education and enterprises of the new industry. The described model can be considered as an option to create favorable conditions for the vocational guidance of high school students. The informational, technical, methodological, psychological components of interaction are presented. A significant result of the work is that I.V. Ivanova, N.G. Ivanov (Ivanova, Ivanov, 2019) note the need to support the development of analytical thinking in terms of designing the career path and responsible attitude when choosing the profession.

M.M. Albogachieva, E.V. Ozdoeva identify the peculiarities of support for career guidance at school using the example of specialized training for high school students (Albogachieva, Ozdoeva, 2018). The authors, exploring the pedagogical phenomenon of "specialized training", substantiate that professional self-determination is supported by various forms and methods of preparation. As an important result of the work we highlight the idea that the key to high-quality and effective career guidance is full and timely informing students about new and popular professions. When building the career path, the student's interest in the profession and the ratio of professional preferences and market requirements are transformed.

The methodological approach to the organization of career guidance is presented by A.V. Brehova, M.A. Golubeva (Brehova, Golubeva, 2017). On the example of technology classes the authors describe the system of work with parents, individual consultations with students on the choice of the profession and career planning.

As the analysis showed, only some of the researchers (Gurtov, Hoteeva, 2018) suggest using the potential of information technologies to support students' professional self-determination. At the same time, there is a wide range of scientific works where it is proved that the inclusion of digital services in the cognitive process contributes to the solution of educational and career-oriented tasks (Shulgina et al., 2018), supports the development of mental processes: thinking, memory, attention and imagination (Kholodnaya, Gelfman, 2016).

Moreover, I. Makarova, K. Shubenkova, D. Antov, A. (Makarova et al., 2019), when studying the digitalization of all areas of the activity, global problems in the economy and education, prove that information technology is becoming an integral part of the human life. Scientists justify that "a universal approach to smart education is needed." The education system should ensure high-quality training of engineers who are necessary for business and society. The capabilities supported by computer modeling, simulators, alternate and virtual reality should be used to achieve this goal. The development of this idea was carried out in the work of E.V. Soboleva, A.N. Sokolova, M.L. Votinceva (Soboleva et al., 2018), when the authors designed cognitive activities of students using problem-solving environment with nonlinear representation of information. Students go through a text labyrinth solving training tasks, at the exit of which they receive recommendations regarding the choice of the profession for the future. It is clear that to perform these activities teachers need to be taught . The peculiarities of preparing teachers to use digital technologies in the

didactic process were studied in the work of E.V. Soboleva, M.V. Perevozchikova (Soboleva, Perevozchikova, 2019).

Thus, the analysis allows us to objectively conclude that career guidance should be carried out in two directions: navigation of students in popular professions of the future and the formation of the competence of professional self-determination. The potential of digital technologies to support each of these areas is not enough used.

2.1.2. Analysis of foreign researches

As an initial conclusion we note that the concept "career guidance" is not used in foreign studies. The terms "career planning" and "career development" should be considered its analogues.

A wide range of works is devoted to identifying psychological aspects of career management (Lee et al., 2016), other scientists pay more attention to the socio-economic factors of professional self-determination (Noga, 2016). In all modern approaches the role of digital technology for the design of the career path is highlighted, it is especially important for our study. In particular, L. Ilomäki, M. Lakkala study the impact of digital media on improving the quality of the education system regarding the formation of competences which will be in demand in the future (Ilomäki, Lakkala, 2018). The authors note that the capabilities of information technology are still not used effectively (more often to solve one or two educational problems). As a result, graduates do not have sufficient experience in conducting independent research activities, in organizing collaborative work, in planning the individual learning path. L. Ilomäki, M. Lakkala introduce the term "digital competence", which is the backbone for the innovative model of the school community.

Both foreign and domestic researchers describe in detail the factors and conditions that affect professional self-determination and career path design: parental expectations, cultural norms, personal interests and needs, success in studying school subjects (Davies et al., 2014). The study by B. Lee, E. J. Porfeli, A. Hirschi showed that special attention should be paid to the motivational processes underlying career path building (Lee et al., 2016).

Approaches that reflect the importance of early professional self-determination are developed in the scientific community abroad (teWierik et al., 2015). Issues of the impact of university studies on professional adaptation and career are also of interest (Noga, 2016). H. Noga's study was conducted among graduates after their graduation. During the survey, answers regarding questions of the motives for choosing the specialization, the practical application of the gained knowledge, the impact of training on professional status and career growth were received. It is interesting to conclude that many of the respondents noted the positive impact of university studies on both personal life and professional self-determination (Noga, 2016).

N. Galliott, L. J. Graham, note that one of the directions of Australian public policy is to reduce unemployment by improving the quality of career guidance at school (Galliott, Graham, 2017). Scientists analyze the findings of other researchers regarding the impact of the well-being of young people (social status, material wealth of the family) on their career aspirations, professional guidelines. N. Galliott, L. J. Graham, do not agree with these conclusions and prove that the possibility of network communication and obtaining information about professions has a greater influence on the choice of the profession. However, this is not always fair. The authors give examples of various government Internet resources focused on supporting professional self-determination (Galliott, Graham, 2017). And at the same time, they noted that the unemployment rate continues to grow. As a possible reason, the presence of a large number of young people who do not have a clear idea of their preferences is indicated. Such uncertainty may be due to psychological characteristics (low self-esteem, increased anxiety, and perfectionism), educational experience, and the influence of parents. But, of course, one should take into account the influence of timely and relevant informing students on career path building: where to go, what professions exist and what requirements employers have. This position was examined in more detail by N. Galliott when she analyzes and summarizes the practice of including online resources for professional self-determination (Galliot, 2017). The author notes that digital technologies save time resources; they are quite convenient and easy to use. However, the real value of such portals in practice is significantly reduced for the following reasons: students do not know about them; information about professions is contradictory or incomplete.

Continuing on the problem of awareness, we turn to the work of J.P. Sampson, J.P. Makela (Sampson, Makela, 2014). The authors describe the ethical problems of including digital resources

(web portals, social networks, mobile services) in professional self-determination support. These problems are divided into three groups: social justice, resources and services. For example, uneven access to the computer network, unequal material opportunities for acquiring high-tech devices, differences in levels of digital competence. As a result, there is social injustice in supporting career path planning for various social groups.

Some works indicate the importance of developing special software tools to support learning. For example, G.V. Fabic, A. Mitrovic, K. Neshatian offer to support the acquisition of new knowledge, independent research activities by the virtual assistant written in Python (Fabic et al., 2017). The authors argue that inclusion of mobile applications-tutors will increase effectiveness of training.

T. Terzidou, T. Tsiatsos, H. Apostolidis describe a model of interaction in 3D virtual learning environments in order to support online educational activities деятельности (Terzidou et al., 2018). The authors argue that inclusion of intelligent systems increases effectiveness of innovative teaching methods. In the proposed three-dimensional multi-user virtual environment users explore the worlds, communicate with other participants, organize online meetings or even use them as a learning space.

M.R. Ali, E. Hoque (Ali, Hoque, 2017) organize social skills training with the support of the virtual assistant. The authors start from the position that non-verbal signals are an important component of social communication, and develop the virtual assistant as a means of receiving emotional (smile, look, body language) feedback in real time. The application is accessible through a browser.

S. Carlos, D. Peña, F. Gómez-Estern (Carlos et al., 2015) suggest using the virtual assistant to individualize learning and generate exercises. The advantage of the tool is that its use does not require the teacher or students to have special programming skills and databases. The application automatically collects, stores and classifies tasks.

Due to the fact that the professional self-determination support for students is a priority of the modern educational space, there is an objective need to realize the didactic potential of digital resources for building individual career paths.

3. Materials and methods

3.1. Theoretical and empirical methods

When choosing forms of organizing career guidance in the educational space, we used general scientific methods of analysis and comparison, based on the results of which the necessary conceptual apparatus was drawn up: the competence of professional self-determination, personal career paths, and the virtual assistant.

The decision to develop a software tool for professional self-determination support was preceded by the analysis of existing profession navigators, open information resources. To improve the quality of career guidance in the digital school using the Java language, the virtual assistant that reflects the author's approach to the research problem was implemented.

The research methodology is supplemented by E.A. Klimov's questionnaire, used when identifying the professional orientation of the student personality (Klimov's differential diagnostic questionnaire). To assess the level of awareness of students, an additional questionnaire was developed and conducted. The content of the virtual assistant was based on the results of M.A. Holodnaya's research on the nature of cognitive styles (Holodnaya, 1992).

When studying the practice of including information resources in career guidance activities, praximetric methods were used, which involved assessing the results of students' cognitive activities in the virtual environment.

A special group consists of empirical methods (observation, analysis of the results of working with the digital assistant) and the method of student self-assessment to obtain relevant information about changes in students' professional preferences, development of general intellectual qualities of the person.

The statistical analysis of the reliability of the results of the pedagogical experiment was evaluated on the basis of processing the obtained data according to the Pearson's chi-square test (Ostapenko, 2010).

3.2. The research base

Assessment of effectiveness of professional self-determination support for students in the digital educational space was carried out during the pedagogical experiment. The experiment involved 109 high school students of Kirov who in-depth study individual subjects. To fulfill the rules of probabilistic selection, the same mentor conducted career guidance activities throughout the experiment. The experiment was conducted in the specially equipped computer science classes, on the same software. To assess the input conditions, questionnaire materials, atlas of new professions were used. All questions and tasks were developed by the authors in accordance with the requirements of state federal educational standards.

3.3. Stages of research

The study was carried out in three stages.

At the first stage the state of topical problems of the organization of career guidance in the modern educational space is investigated. For this, the analysis of the scientific literature, the study and comparison of innovative experience of specialists competent in the field of building the personal career path in order to identify the necessary changes are carried out. At the same stage, Klimov's differential diagnostic questionnaire were used, the questionnaire to identify the level of awareness, and testing (10 tasks, each rated at 2 points). Further, students were divided into groups (experimental – 55 students, control – 54 students), so that it was guaranteed that the same professional preferences and their equal distribution were present in each group. Characterizing the sample, it should be noted that in the experimental group there are 69 % of girls and 31 % of boys.

The second stage is devoted to determining the directions for improving the forms of professional self-determination support for students in the context of new requirements of the digital society and the capabilities of modern software tools. The need for development of the digital tool that provides information about professions of the future and contributes to building the personal career path is found out. Functionality of the digital resource to support the formation of the professional self-determination competence, mastery of methods of the mental activity, and general intellectual skills are determined at this stage.

The third stage of the study covers the experienced teaching and improvement of virtual support. The work is accompanied by constant monitoring of changes in professional preferences, the formation of intellectual qualities of the person. After each new address to the virtual assistant the results are stored in a database for subsequent analysis. Discussion of the results of the study takes place in the form of publications in journals and reports at conferences at various levels.

4. Results and discussion

4.1. Clarification of the essence of the basic concepts

The authors propose the following approach to the disclosure of the essence of professional self-determination: it is the central aspect of personal development (awareness of needs, interests, motives, opportunities, abilities and limitations). The personal career path is considered to be a professional educational program that supports the implementation of the training standard and provides the possibility for the individual with the help of a tutor/teacher/mentor to build his/her own professional development path. Then the formation of the competence of professional self-determination provides the opportunity to build the professional path, starting with the choice of the future profession, taking responsibility for the choice made and subsequent results. The basis of this competence is the ability to learn, to develop throughout the life.

In this research the virtual digital assistant is understood as a service and/or application for smartphones and personal computers that takes on the functions of determining cognitive, intellectual styles and styles of cognitive attitude to the world. The analysis of digital resources that support navigation in popular professions (HeadHunter; Navigatum; Uchoba) allows us to conclude that most of the resources take into account E.A. Klimov's methods, they contain questions in the sort of "choose option", they are guided by the current labor market. In most cases (for example, Testometrika), the resource determines professional inclinations at a particular point in time without saving and analyzing the results. The navigator suggested by Higher School of Economics occupies a special niche, but it is paid, which limits students in its active use (Atlas of the professions of the future).

The presented virtual assistant is different from others in the field of analysis of the effects of scientific, technical and innovation policy in that for the first time the capabilities of modern digital

technologies have been applied to visualize the cognitive processes in order to support students in choosing the most appropriate for their future needs and individual characteristics the future profession in demand. The model saves previous test results and realigns the professional development path.

To identify the essence of the necessary psychological phenomena, the works of domestic and foreign scientists on the research issues were analyzed: M.A. Holodnaya (Holodnaya, 1992), S. Papert (Papert, 1993), O.A. Khalifaeva (Khalifaeva, 2018) and etc.

As important conclusions, allowing emphasizing the value of the presented virtual assistant, we note:

1. Traditionally defining the formation of skills as the main aim of training, one should think about the quality of acquired knowledge. In the future, knowledge in general will not be claimed, but knowledge that contributes both to the explanation of the phenomena of the surrounding reality and to effective action in various situations. In fact, we are talking about intellectual competence, which involves a special type of organization of knowledge that provides the ability to make effective decisions.

2. In order to support the formation of intellectual competence in practice, the composition and structure of mental experience (intelligence), the relationships and interactions between its components should be determined: cognitive experience, metacognitive experience, intentional experience.

3. The personal cognitive style as an individually-unique way of studying reality is formed on the basis of cognitive, intellectual styles and styles of cognitive attitude to the world.

The information model is based on classifications and criteria formulated by M.A. Holodnaya: field dependence/field independence; narrowness/breadth of the range of equivalence and other (Holodnaya, 1992).

4.2. Digital professional self-determination support for students and building the individual career path

To determine the effective conditions for professional self-determination support for students in the modern educational space, new digital technologies should be used more actively. The programming language Java was chosen as a development technology, as it has been taking the first place in the TIOBE international index for a long time. In addition, it is object-oriented, cross-platform, and has a large number of libraries. To implement the virtual assistant interface we used the JavaFX tool, which is a powerful toolkit for creating cross-platform graphical applications on the Java platform. This tool allows developing applications in accordance with the MVC design pattern. What is important for visualization is that the work with JavaFX allows to develop an interface using CSS (i.e., similar to the interface of web pages).

The following models were introduced to achieve the aim of the study: Task (for example, for the test “Included Figures”), Question (for example, for the test “Average Judgment”). An example of the interface and tasks is presented in Fig. 1. The graphical interface is described in the fxml file. The logic of work with each Scene is realized in the corresponding controller. For background sound, the standard JavaFX libraries – javafx.scene.media.AudioClip are used.

Let us reveal the informative content of the virtual assistant in accordance with the personality qualities that form the basis of the ability "to be able to learn".

1. The breadth of mental horizons (as opposed to "encapsulated consciousness"). The formation of this quality is closely related to the worldview aspect. It is important to learn to see the common in heterogeneous. The research of information processes and work with digital resources provide good opportunities for it. As examples we can consider the following: the unity of control processes in systems of various natures; the ability to use the same data structure to describe seemingly different objects; the same patterns according to which logical expressions are built; character sequences are processed. The virtual assistant provides tasks where the same question is given to be solved by mental calculation and for calculation in spreadsheets and for writing in a programming language (block diagram). Here is another example of the formation of this quality of the mind: to develop the ability to see phenomena from an unexpected perspective. In the virtual environment, users are faced with the situation of using negative digits in the alphabet of the number system; representing 4,00 as a real, not as a whole.

2. Flexibility and multivariance of assessment of what is happening (as opposed to “black-and-white” consciousness). This quality is actively developed in the course of project and

collaborative activities, when working in conditions of uncertainty. This is due to the fact that readiness to search for new solutions suitable for different situations, to exchange ideas with other students and the teacher, to perceive “someone else's” decision is formed. Attitude to errors as a natural stage in the process of cognition is important, and, therefore, readiness for their search and correction. For example, there is a solution to a task that works on a specific set of input data. However, for other values it is erroneous. The error can be due to the logic of the initial solution, due to unaccounted conditions. The computer itself acts as a kind of upbringing. It’s useless to argue with it – the system does not work. The virtual assistant also uses tasks for several interpretations of the same concept, for example, information, culture, system, democracy.

3. Readiness to unusual, conflicting information (as opposed to dogmatism). Since the computer processes data according to the laws of formal logic, the results of its operation under certain conditions may contradict our usual ideas. The virtual assistant implements situations when the result of adding a positive number can be a negative number. The experience of overcoming such difficulties teaches us not only to find a reasonable explanation for unusual, at first glance, phenomena, but also to find ways to apply them. The developed digital resource also contains tasks for comparing phrases recorded in natural and formal (i.e., computer-oriented) languages. For example, there is a task written in natural and formal languages. To match the solution and the task. To find a mistake.

For many users it is a significant difficulty to abandon the usual means of expressing thoughts, words and phrases, the meaning of which seems to them indisputable. For example, a list of students born in 1990 AND 1991 is required. The request (filter condition in the information system) is: Year of birth is 1990 OR year of birth is 1991.

Another example: “Double the value of variable A”. In the formal language, the entry is as follows: A: = 2 * A (not 2 * A).

4. The ability to comprehend what is happening simultaneously from the perspective of the past (causes) and in terms of the future (consequences) (as opposed to the tendency to think in terms of "here and now"). When building information models, the ability to foresee all possibilities, anticipate the consequences of decisions made, and predict how the system works in various situations plays a crucial role. The virtual assistant provides tasks for testing the finished model, data selection, modeling of possible user behavior. Didactic and heuristic tasks involving interdisciplinarity are also used.

The example. Assess if the statement is true or false:

a) if oil spills in the ocean, many animals will die. We see a large number of dead pelagians, which means they died due to the oil spill in the ocean;

b) a rainbow appears in the sky after rain. Now you can see a rainbow in the sky, so, it has recently rained.

5. Focus on identifying essential, objectively significant aspects of what is happening (as opposed to the subjective, egocentric cognitive position "I do not need this"). This cognitive conflict can be observed in the students' attitude to fundamental concepts, laws and principles. Especially when the teacher does not pay attention to the motivation to develop and identify the relationship between fundamental and applied knowledge. For example, if the topic is difficult to understand and has no obvious practical usage. Indeed, why know the computer organization and the history of the development of computer technology if this is not required for sending mail and working in office programs. Many laboratory classes come down to practice according to instructions, which describe the sequence of actions without specifying their theoretical meaning in detail. This work is simple and understandable for participants of the didactic process. This shortsightedness is demonstrated not only by students and parents, but also by the teachers themselves. But practical benefits are few. The device interface, control techniques are mastered, but the problem cannot be solved. We need to use fundamental scientific theory, i.e. knowledge should be the starting point in the path of developing the new. The theory independently obtained in the process of solving tasks and overcoming difficulties is remembered for a long time.

In the digital school, educators are tempted to study vivid facts, new tools, and technologies. But it is important to maintain a balance, giving priority to the fundamental, and constantly motivate, explain, prove the correctness of this approach. In the virtual assistant, it is taken into account when developing concepts, a sequence of actions. For example, to match the term and the

concept; to restore the sequence of actions in the algorithm of a segment division in half, to solve a quadratic equation.

Another example. An atelier has an order for sewing a raincoat. One of the steps in solving this task is to create a sketch of the raincoat. Choose the properties of the modeling object that are significant for the specified purpose (creating a sketch of the raincoat): the price of the fabric for the raincoat, the length of the raincoat, the model of the sewing machine, the fabric needed to sew the raincoat, the shape of the sleeves of the raincoat, and if a hood is needed.

6. The tendency to think in probability categories "as if" (as opposed to ignoring impossible events). Students will encounter these events in the future. In the virtual assistant, this skill is formed and tested through the evaluation of unusual facts. For example, the square root of four in the calculation will not be equal to two. Or, "what are the consequences of acid rain: will fish reproduction be better; will chemical properties composition of soil and water change; will harmful bacteria die; will the number of water reservoirs increase"?

Another example: "In 1626, the Indians sold Manhattan Island for $ 20. If this money was placed in a bank and the annual increase was n percent, then what was the capital in 2019?"

7. The ability to mentally see a single phenomenon in the context of its holistic relationships with many other phenomena (as opposed to a single-line view of the world). One and the same concept can be used in various fields and without essential changes have a special semantic connotation in each of them. For example, the concept "file". A file is considered both as a structural unit of information organization when it is stored on an external storage medium, and as a named area of an external storage medium, and as an object of operating system processing.

Another example: choose from the list only those elements that will be presented as independent objects in the information model of the information system for recording orders at the hairdresser's: the hairdresser, the client, the service, `equipment, acquaintance of the client with the list of services, the client's choice of the service, the client's choice of the hairdresser, the client's hair appointment.

Thus, the model has cognitive styles. In particular, the characteristics of information processing styles are taken into account (see Fig. 1): in the form of signs (numbers, scale); in the form of visual images (infographics); in the form of objective actions (clicking, dragging and dropping); in the form of sense-emotional impressions (with predominance of the auditory or emotional component).

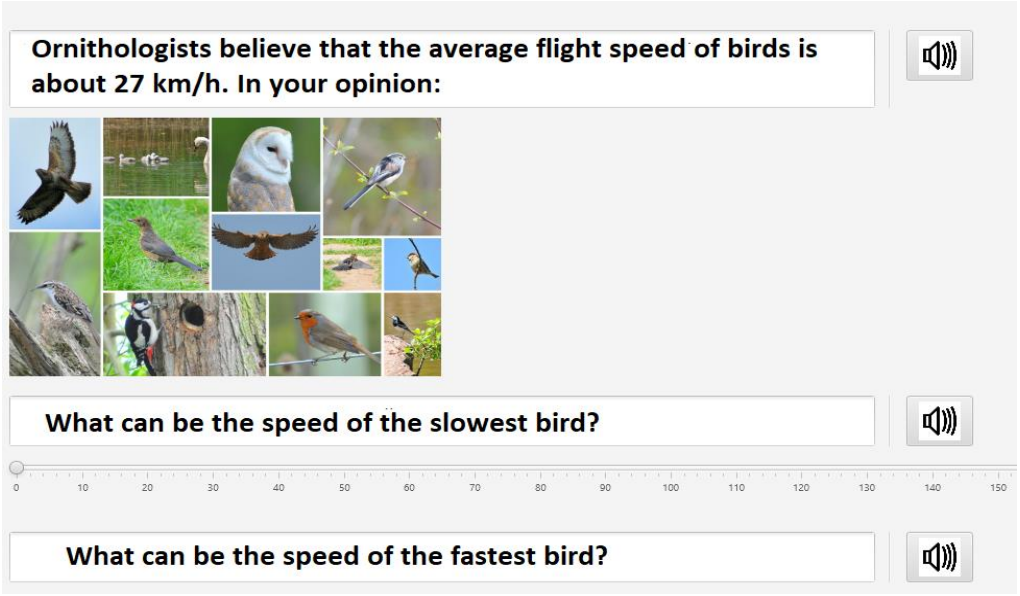


Fig. 1. Example of the method

Based on the results of the tasks (intellectual styles, styles of cognitive attitude to the world are assessed), the virtual assistant formulates recommendations for choosing the professions of the

future. For example, that the future profession should involve creative activities, the search for new solutions, or vice versa, involves reproducing and a strictly defined algorithm.

Let us describe the work of the virtual assistant using the example of choosing the profession of the future for a particular student. The following are the results of the pedagogical experiment for the young man who used the service for career guidance. The initial interests of the young man were in medicine, biology. Out of other psychophysical features, we note a tendency to artistry, sociability, mobility. The young man did not experience problems of social adaptation; his parents supported his every initiative.

The results of the method "Focusing – scanning control": regarding the features of concentration and distribution of attention in perceiving what is happening, your cognitive style is the style of scanning control. The characteristic of your style: you readily focus on the important, essential element of the perceived situation, and you can mentally cover all other aspects of the situation. You quickly distribute attention to many aspects of the problem and emphasize the objective details. You are able to control your affective states in the acts of cognition and decision making. When sorting emotionally significant and neutral material, you can record a greater number of objective details in the problem and take into account your emotional impressions to a lesser extent. You can perceive a large amount of information at once, but it is difficult for you to concentrate on one thing in the presence of several objects. If a detailed study is required, then you need to be presented the material partially.

According to the results of the method "Impulsivity – Reflectivity", your cognitive style is reflective. Characteristic of your style. You are inclined to put forward various hypotheses not out loud and test them, and only then give an answer. You need to be given more time to make a decision, not to be required an instant response. But you make mistakes less often than people with the impulsive style. To make decisions, before answering, you collect more information about the incentive, you use more productive methods for solving problems, and more successfully apply activity strategies acquired in the learning process under new conditions. People with your cognitive style tend to be less sensitive to rewards (rewards for the correct answers). When studying the exact sciences, people with the reflexive style do better in tasks under low control conditions compared to impulsive ones, who are more effective under high control. Reflective people are more field-independent than impulsive. They have higher stability of attention (and its concentration), they use feedback more efficiently, have better visual and aural short-term memory. You are characterized by reliance on the number of elements (features), i.e. analyticity at the level of perception, and greater verbal intelligence.

According to the results of the method "Field dependence/field independence", you have a field dependent cognitive style. Characteristic of your style: field-dependent people rely on the help and support of others. It is much easier for them to answer questions when they hear approving assessments of their answers. They prefer collective forms of activities; in the presence of other people they improve their performance. Such people are much more interpersonal-oriented, they can receive much more information in the process of communicating with others, they engage in conflicts less, tend to change their views in accordance with the position of authorities. On the other hand, the ability of field-dependent people to resort to the opinions of others can be perceived as a necessity, the need to search for information in order to use the latter when structuring an uncertain situation, because they can do it themselves weaker. Another object is both a source of information, and a method, and an instrument for its processing. Such people need the presence of all their socially useful qualities.

Representatives of the field-dependent style trust visual impressions more when assessing what is happening and hardly overcome the visible field if it is necessary to detail and structure the situation. Field-dependent people use a globally holistic approach to solve the problem, which involves a lot of work of the right brain.

The list of professions recommended by the virtual assistant (in the order of their ranking according to the analysis criteria): Telemedicine doctor, Genetic consultant, Medical robot designer, Molecular biologist, Developer of medical gadgets.

Thus, a holistic software implementation of the virtual assistant for visualizing and schematizing a difficult choice of the profession is described. We emphasize that the initial purpose of the digital resource is to diagnose the student and determine the input conditions for the learning model. However, during the research, additional significant results were obtained.

The experimental work in the framework of the testing program allowed implementing an educational project that allows its participants to get acquainted with the professions of the future while playing. The virtual assistant can also be considered as a tool, a means of managing the personal path of personality development in the future.

4.3. Experimental evaluation

4.3.1. The ascertaining stage of the experiment

At the first stage of the experiment, a survey was conducted among students according to E.A. Klimov's methods to identify the professional orientation of the student's personality (Klimov's differential diagnostic questionnaire). The diagnostic results allowed us to conclude that the largest number of respondents is inclined to the interactions "man-man" (31 %) and "man-technical equipment" (25 %). For other types "man-nature", "man-art", "man-semiotic system" we got 14 %, 12 %, 18 % respectively.

To verify the validity of the experiment results, students were asked on a scale of «one» (do not match) up to «four» (completely match) evaluate their agreement/disagreement with the results obtained. The results of testing before and after the experiment are shown in Table 1. Processing of results is performed in section 4.3.2. (Forming stage of the experiment).

Table 1. The results of the test

Level	Groups			
	The experimental group (55 pupils)		The control group (54 pupils)	
	Before the experiment	After the experiment	Before the experiment	After the experiment
4	9	10	10	9
3	26	28	20	21
2	14	11	22	21
1	6	6	2	3

To assess the level of awareness of students, an additional questionnaire was developed and conducted. For example, do you imagine the nature and content of the future profession? The possible answers were the following: «yes, entirely»; «I have an idea that this profession exists»; «I did not think about choosing a profession». The corresponding results are shown on the diagram (see Figure 2). Processing of results is performed in section 4.3.2. (Forming stage of the experiment).

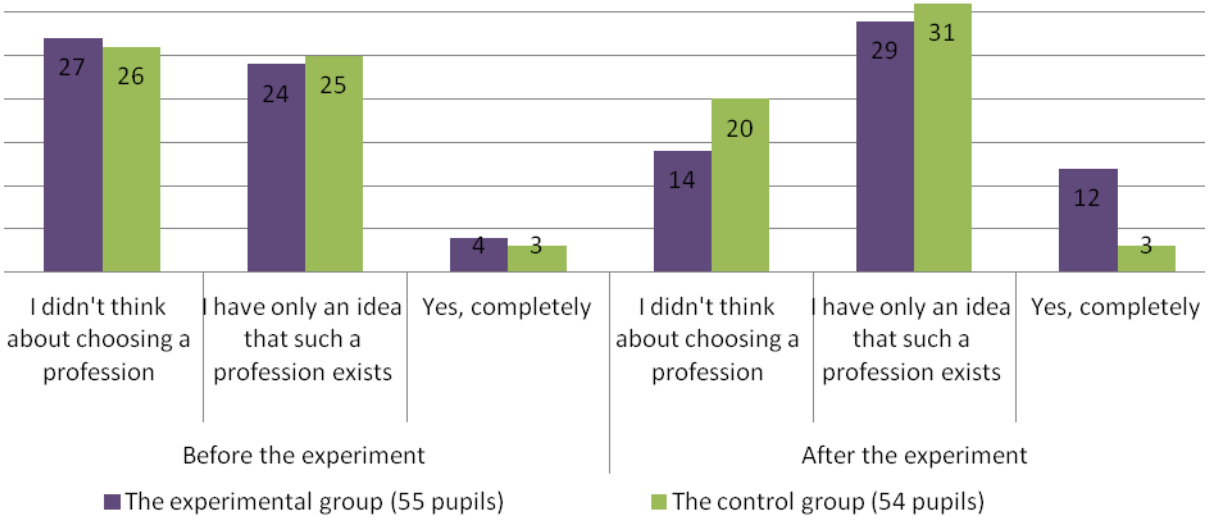


Fig. 2. Test results

A list of skills, which were subsequently assessed, was made up and tasks corresponding to this set were developed. Further, the entrance testing was conducted among the participants. Based

on the fact that the assistant is focused on supporting the professional self-determination formation for students and on the development of personality traits that form the basis of the ability to "be able to learn," there were two types of questions in the test. Thus, there were 10 tasks: 5 questions of each type. Two points were given for each question. If the student received more than 17 points, then the skill level was defined as "high"; the range from 9 to 16 (inclusive) corresponded to "average" level, results below 16 corresponded to "low" level. An example of the first type question: indicate competences that are in demand among employers (creativity, critical thinking, ability to quickly count, initiative, flexibility and stress resistance, large amount of knowledge).

An example of the second type question: the steps of constructing an information model are listed and it is necessary to put numbers on the left of the step in order: formalization, model analysis, analysis of the modeling object and highlighting its properties, choosing the form for representing the model, setting the goal of modeling, determining the practical problem, for which the model will be built.

4.3.2. Forming stage of the experiment

Interaction with the virtual assistant was included in career guidance activities with students of the experimental group. For participants in the control group, professional self-determination support was traditional: they had meetings with employers, career-oriented class hours, newsletters about the admission requirements to various educational institutions.

In order to assess the effectiveness of the proposed approach at the end of work with the virtual assistant the students were asked to complete the final task. Questions for self-esteem were proposed to determine changes, the identification of professional preferences. In the process of the final event a series of tasks was also formulated, which involved assessing changes in the formation of the professional self-determination competence and personal traits, which form the basis of the ability to "be able to learn". In testing, when formulating questions, the mentor took into account the difficulties that participants faced when interacting with the virtual assistant. For example, to match employer requirements with universal skills.

Requirements of employers: to be ready to constantly learn something new; to be on a first-name basis with machines and technologies; to be able to do what machines cannot; to think rationally, holistically and systemically; the ability to act in situations of uncertainty; to cope with the increasing complexity of the world; to freely navigate in large flows of information.

Universal skills: emotional intelligence; design thinking, project thinking, system thinking; self-learning, knowledge of languages, cross-functionality; stress resistance, maintaining own psychological and physical health; creativity, enterprise, ability to collaborate with other people; ability to sum up, to choose necessary, analytical skills; technological literacy, programming skills. The results of testing before and after the experiment are shown in Table 2.

Table 2. The results of the test

Level	Groups			
	The experimental group (55 pupils)		The control group (54 pupils)	
	Before the experiment	After the experiment	Before the experiment	After the experiment
High	3	11	5	6
Average	8	27	9	16
Low	44	17	40	32

Carrying out the quantitative analysis of the above results, we can conclude that after the experiment was completed 20 % of the students in the experimental group had a high level of skills and abilities, while initially this percentage was 5 %. For 49 % of the respondents in the experimental group, the fixed level is average, while initially this percentage was 15 %. This suggests a qualitative improvement in learning of respondents in the experimental group. At the same time, the level of skills in the control group also increased, but not so significantly: after testing only 11 % of the participants in the control group showed high results (compared with 9 %

before the experiment), 30 % of the respondents remained at the average level (17 % before the experiment) and low (59 %) level.

4.3.3. Control stage of the experiment

The statistical analysis of the reliability of the results of the pedagogical experiment was evaluated on the basis of processing the obtained data according to the Pearson's chi-square test. We calculate the value of the statistic of the criterion before ($\chi 2_{obs.1}$) and after ($\chi 2_{obs.2}$) the experiment using the online resource http://medstatistic.ru/calculators/calchit.html. Then we choose the significance value $\alpha = 0{,}05$.

To implement the criterion (for Klimov's different diagnostic questionnaire), the following hypotheses were adopted: H0: the level of coincidence of professional aptitudes and interests of students in the experimental group is statistically equal to the level of the control group; H1: the level of matches in the experimental group is higher than in the control group. According to partition tables χ^2 for $\nu = 3$ and $\alpha = 0{,}05$, the critical value of the statistic is 7.82. Thus, we obtain: $\chi 2_{obs.1} < \chi 2_{crit}$ (4,64 < 7,82), a $\chi 2_{obs.2} > \chi 2_{crit}$ (8,58 > 7,82). According to the decision-making rule, this means that the hypothesis *H0* is valid before the experiment, and hypothesis H_1 is true after the experiment.

To implement the criterion (for level of awareness about professions), the following hypotheses were adopted: H0: the level of knowledge about professions in the experimental group is statistically equal to the level in the control group; hypothesis H1: the level of knowledge about professions in the experimental group is higher than the level of the control group. In this case $c = 3$. According to partition tables χ^2, the critical value of the statistic is 5.99. Thus, we obtain: $\chi 2_{obs.1} < \chi 2_{crit}$ (0,21 < 5,99), a $\chi 2_{obs.2} > \chi 2_{crit}$ (6,6 > 5,99). According to the decision-making rule, this means that the hypothesis *H0* is valid before the experiment, and hypothesis H_1 is true after the experiment.

To implement the criterion (formation of the professional self-determination competence and the general intellectual qualities) the following hypotheses were adopted: H0: the level of formation of skills, abilities and personal qualities of the experimental group is statistically equal to the level of formation of the control group; hypothesis H1: the level of formation of skills, abilities and personal qualities of the experimental group is higher than the level of the control group. Thus, we obtain: $\chi 2_{obs.1} < \chi 2_{crit}$ (0,8 < 5,99), a $\chi 2_{obs.2} > \chi 2_{crit}$ (8,9 > 5,99). According to the decision-making rule, this means that the hypothesis *H0* is valid before the experiment, and hypothesis *H1* is true after the experiment.

Thus, the experimental assessment confirms the qualitative difference in relation to the formation of the professional self-determination competence and the general intellectual qualities of the person.

The sample was not probabilistic, since the experimental and control groups were formed in such a way that it was guaranteed that each group had the same professional preferences and their distribution. Throughout the experiment, work with the virtual assistant was carried out by the same mentor, on the same software equipment in special computer science classes. Since the initial stage of the experiment took into account the results of a survey of students, previous educational achievements, and the opinions of a team of teachers.

Participants of the experimental group significantly increased the level of skills that form the basis of the useful skill "to be able to learn". Of particular importance for building the personal development path is the fact that the virtual assistant stores the results of previous tests in the database and makes up a set of recommended professions. In addition, the choice is always the student's. The digital resource offers the most suitable options that take into account the qualities of the mind and professional preferences.

The analysis of the cognitive activity of students also allowed us to confirm that the use of the virtual assistant provides additional opportunities for directing the learning process according the needs of education of the future due to interactivity and enhanced feedback, and activation of information interaction.

On the other hand, in the course of the experiment, we had to solve didactic and technical problems: explaining the principles of the virtual assistant to parents, debugging and testing the program for correct diagnostics, low level of language training, high time and labor costs both for students and teachers.

In general, the pedagogical experiment allows us to conclude that the inclusion of the virtual assistant in career guidance activities allows to determine students' professional preferences more accurately, identify competitive personality traits, support professional self-determination and career path planning.

5. Conclusion

The results of the study prove that the new challenges and requirements of society, the state, and business on the educational system necessitate the formation of students' competence in professional self-determination, taking into account intellectual capabilities. The main role in career guidance is the role of the teacher. But functionality of digital resources allows to use them not only to inform about the popular professions, but also to build the career path. The practical implementation of the corresponding opportunities in the modern educational space has singular examples, most often it is unsystematic.

The development of the presented virtual assistant to support professional self-determination and career path was preceded by the analytical work: the essence of the phenomena “professional path”, “professional self-determination”, “intellectual competence”, and “styles of cognitive attitude to the world” were studied. A justified choice of methods of psychological and pedagogical tools, in accordance with the capabilities of digital technologies, personality characteristics, taking into account the requirements imposed on specialists of the future, allowed the development of the information model to support the formation of the necessary competence of the student’s personality. Pedagogical support is presented by the description of the system of work in the virtual software environment.

The effectiveness of the proposed approach is confirmed by the pedagogical experiment, during which the assessment of changes in the students' professional preferences and in the results of career guidance activities supported by digital technologies was made. Positive changes were recorded in the development of such demanded personality traits as the breadth of mental horizons, flexibility and multivariance of assessment of what is happening (as opposed to “black and white” consciousness), readiness to unusual, conflicting information, the ability to comprehend what is happening simultaneously from the perspective of the past (causes) and in terms of the future (consequences), etc. Thus, the use of the virtual assistant in career guidance activities of the digital school can increase the effectiveness of training students, the conscious choice of profession that will be in demand in the future, development of mental qualities that form the basis of the skill "to be able to learn."

A promising direction for improving the proposed virtual assistant is seen in supplementing it with capabilities that support the choice of an educational institution or a potential employer.

References

Atlas of the professions of the future –"Atlas of the professions of the future": navigator of large and small affairs in the world of the XXI century. [Electronic resource]. URL: https://issek.hse.ru/atlasfutureprofessions [in Russian]

Albogachieva, Ozdoeva, 2018 – *Albogachieva, M.M., Ozdoeva, E.V.* (2018). Professional'naya orientaciya v shkole v kontekste zadach profil'nogo obucheniya starsheklassnikov [Vocational guidance in school in the context of the tasks of profile training for high school students]. *Perspektivy Nauki i Obrazovaniya.* 3(33): 273-277. [Electronic resource]. URL: https://pnojournal.files.wordpress.com/2018/06/pdf_180346.pdf [in Russian]

Ali, Hoque, 2017 – *Ali, M.R., Hoque, E.* (2017). Social skills training with virtual assistant and real-time feedback. *Proceedings of the 2017 ACM International Joint Conference on Pervasive and Ubiquitous Computing and Proceedings of the 2017 ACM International Symposium on Wearable Computers (UbiComp ’17).* New York: Association for Computing Machinery: 325-329. DOI: https://doi.org/10.1145/3123024.3123196

Brehova, Golubeva, 2017 – *Brehova, A.V., Golubeva, M.A.* (2017). Proforientacionnaya rabota s obuchayushchimisya starshih klassov na urokah tekhnologii [Career guidance with high school students in technology lessons]. *Perspektivy Nauki i Obrazovaniya.* 5(29): 53-56. [Electronic resource]. URL: https://pnojournal.files.wordpress.com/2017/08/pdf_170510.pdf [in Russian]

Carlos et al., 2015 – *Carlos, S., Peña, D., Gómez-Estern, F.* (2015). Virtual assistant for individualized practical training on controller design. *IFAC-PapersOnLine*. 48(29): 205-210. DOI: https://doi.org/10.1016/j.ifacol.2015.11.238

Davies et al., 2014 – *Davies, P., Qiu, T., Davies, N.M.* (2014). Cultural and human capital, information and higher education choices. *Journal of Education Policy*. 29(6): 804-825. DOI: https://doi.org/10.1080/02680939.2014.891762

Dezhina, Klyucharyov, 2018 – *Dezhina, I.G., Klyucharyov, G.A.* (2018). Rossijskoe obrazovanie dlya innovacionnoj ekonomiki: «bolevye tochki» [Russian education for an innovative economy: "pain points"]. *Sociologicheskie issledovaniya*. 9: 40-48. DOI: https://doi.org/10.31857/S013216250001957-5 [in Russian]

Fabic et al., 2017 – *Fabic, G.V.F., Mitrovic, A., Neshatian, K.* (2017). Learning with Engaging Activities via a Mobile Python Tutor. *André E., Baker R., Hu X., Rodrigo M., du Boulay B. (eds) Artificial Intelligence in Education. AIED 2017. Lecture Notes in Computer Science*. Vol. 10331. Cham: Springer. DOI: http://doi.org/10.1007/978-3-319-61425-0_76

Galliot, 2017 – *Galliott, N.* (2017). Online Career Guidance: Does Knowledge Equate to Power for High School Students? *Journal of Psychologists and Counsellors in Schools*. 27(2): 190-207. DOI: https://doi.org/10.1017/jgc.2017.7

Galliott, Graham, 2017 – *Galliott, N., Graham, L.J.* (2017). School based experiences as contributors to career decision-making: findings from a cross-sectional survey of high-school students. *Australian Educational Researcher*. 42(2): 179-199. DOI: https://doi.org/10.1007/s13384-015-0175-2

Ganseuer et al., 2015 – *Ganseuer, C.Dr., Neretina, E.A., Korokoshko, Yu.V.* (2015). Opyt proektno-orientirovannogo obuchenija i organizacii komandnoj raboty studentov vuza [Experience of project-oriented learning and organisation of teamwork among university students]. *Integracija obrazovanija*. 19(2): 22-30. DOI: https://doi.org/10.15507/Inted.079.019.201502.022 [in Russian]

Gurtov, Hoteeva, 2018 – *Gurtov, V.A., Hoteeva, E.A.* (2018). Planirovanie kar'ernoj traektorii shkol'nikov: orientaciya na «hochu», «mogu» i «nado» [Planning a career path for schoolchildren: focus on "I want", "I can" and "I need"]. *Integraciya obrazovaniya*. 22(1): 134-150. DOI: https://doi.org/10.15507/1991-9468.090.022.201801.134-150 [in Russian]

HeadHunter – HeadHunter. Site for job search and employees in the world. [Electronic resource]. URL: https://hh.ru/ [in Russian]

Holodnaya, 1992 – *Holodnaya, M.A.* (1992). Kognitivnye stili i intellektual'nye sposobnosti [Cognitive styles and intellectual abilities]. *Psihologicheskij zhurnal*. 13(3): 84-93. [in Russian]

Ilomäki, Lakkala, 2018 – *Ilomäki, L., Lakkala, M.* (2018). Digital technology and practices for school improvement: innovative digital school model. *Research and Practice in Technology Enhanced Learning*. 13: 25. DOI: https://doi.org/10.1186/s41039-018-0094-8

Ivanova, Ivanov, 2019 – *Ivanova, I.V., Ivanov, N.G.* (2019). Vklad v reshenie zadach razvitiya nauchno-tekhnicheskogo potenciala podrastayushchego pokoleniya [Contribution to solving the problems of developing scientific and technical cooperation of the younger generation]. *Vestnik Tomskogo gosudarstvennogo universiteta*. 443: 225-235. DOI: https://doi.org/10.17223/15617793/443/27 [in Russian]

Khalifaeva, 2018 – *Khalifaeva, O.A.* (2018). Vzaimosvyaz' kreativnosti i kognitivnyh stilej v period rannej vzroslosti [Relationship of creativity and cognitive styles in early adulthood]. *Sibirskiy Psikhologicheskiy Zhurnal*. 69: 172-190. DOI: https://doi.org/10.17223/17267080/69/10 [in Russian]

Holodnaya, Gelfman, 2016 – *Kholodnaya, M.A., Gelfman, E.G.* (2016). Development-focused educational texts as a basis for learners' intellectual development in studying mathematics (DET technology). *Psychology in Russia: State of the Art*, 9(3): 24-37. DOI: https://doi.org/10.11621/pir.2016.0302 (date of access: 11.02.2020).

Klimov's differential diagnostic questionnaire – Klimov's differential diagnostic questionnaire. [Electronic resource]. URL: https://psychologyc.ru/oprosnik-klimova/ [in Russian]

Klochkov et al., 2017 – *Klochkov, Y.S., Lepehin, A.I., Vasilega, D.S., Vasilega, N.A., Nonieva, K.Z., Vasilyeva, S.E.* (2017). Professional orientation of students. *IEEE VI Forum Strategic Partnership of Universities and Enterprises of Hi-Tech Branches (Science. Education. Innovations) (SPUE)*. St. Petersburg, 165-167. DOI: https://doi.org/10.1109/IVForum.2017.8246081

Kolesnikova, Doneckij, 2016 – *Kolesnikova, O.A., Doneckij, A.M.* (2016). Proforientaciya molodezhi kak faktor smyagcheniya problemy obespecheniya ekonomiki vysokokvalificirovannymi kadrami [Youth career guidance as a factor in mitigating the problem of providing the economy with highly qualified personnel]. *Vestnik Voronezhskogo gosudarstvennogo universiteta. Ekonomika i upravlenie*. 3: 82-87. [Electronic resource]. URL: http://www.vestnik.vsu.ru/content /econ/2016/03/toc_ru.asp [in Russian]

Korolenko, Kalachikova, 2016 – *Korolenko, A.V., Kalachikova, O.N.* (2016). Maturity of teenagers' occupational preferences as a factor in their socialization. *Economic and Social Changes: Facts, Trends, Forecast*. 6: 143-161. DOI: https://doi.org/10.15838/esc/2016.6.48.8

Lee et al., 2016 – *Lee, B., Porfeli, E. J., Hirschi, A.* (2016). Between- and within-person level motivational precursors associated with career exploration. *Journal of Vocational Behavior*. 92: 125-134. DOI: https://doi.org/10.1016/j.jvb.2015.11.009

Makarova et al., 2019 – *Makarova, I., Shubenkova, K., Antov, D., Pashkevich, A.* (2019). Digitalization of Engineering Education: From E-Learning to Smart Education. *Auer M., Langmann R. (eds) Smart Industry & Smart Education. REV 2018. Lecture Notes in Networks and Systems*, vol 47. Cham: Springer. DOI: https://doi.org/10.1007/978-3-319-95678-7_4

Nadprofessional'nye navyki – Nadprofessional'nye navyki [Cross-professional skills]. Atlas novyh professij. [Electronic resource]. URL: http: //atlas100.ru/future/crossprofessional_skills (date of access: 30.06.19). [in Russian]

Navigatum – Navigatum. Educational and research project. [Electronic resource]. URL: https://navigatum.ru/ [in Russian]

Noga, 2016 – *Noga, H.* (2016). The careers of the education in technology graduates. *Society. Integration. Education. Proceedings of the International Scientific Conference*. 2: 223. DOI: https://doi.org/10.17770/sie2016vol2.1379

Ostapenko, 2010 – *Ostapenko, R.I.* (2010). Matematicheskie osnovy psihologii [Mathematical foundations of psychology]. Voronezh: VGPU. 76 p. [in Russian]

Papert, 1993 – *Papert, S.* (1993). Mindstorms: children, computers, and powerful ideas. New York: Basic Books, 230 p.

Pryazhnikov, 2008 – *Pryazhnikov, N.S.* (2008). Professional'noe samoopredelenie: teoriya i praktika [Professional self-determination: theory and practice]. M.: Academy. [in Russian]

Sampson, Makela, 2014 – *Sampson, J.P., Makela, J.P.* (2014). Ethical issues associated with information and communication technology in counseling and guidance. *International Journal for Educational and Vocational Guidance*. 14(1): 135-148. DOI: https://doi.org/10.1007/s10775-013-9258-7

Shafranov-Kucev, Gulyaeva, 2019 – *Shafranov-Kucev, G.F., Gulyaeva, L.V.* (2019). Professional'noe samoopredelenie kak vedushchij faktor razvitiya konkurentoorientirovannosti i konkurentosposobnosti starsheklassnikov [Professional self-determination as a leading factor in the development of competitiveness and competitiveness of high school students]. *Integraciya obrazovaniya*. 23(1): 100-118. DOI: https://doi.org/10.15507/1991-9468.094.023.201901.100-118 [in Russian]

Shulgina et al., 2018 – *Shulgina, T.A., Ketova, N.A., Kholodova, K.A., Severinov, D.A.* (2018) O motivacii studentov k uchastiyu v organizacii meropriyatij professional'noj napravlennosti [Motivating students to participate in professionally oriented events management]. *The Education and Science Journal*. 20(1): 96-115. [Electronic resource]. URL: https://doi.org/10.17853/1994-5639-2018-1-96-115 [in Russian]

Sidelnikova, 2018 – *Sidelnikova, T.T.* (2018). Resources and Risks of Moderation as an Interactive Method of Furthering Teamwork Skills among Students of Higher Education Institutions. *Integratsiya obrazovaniya*. 22(2): 369-382. DOI: http://dx.doi.org/10.15507/1991-9468.091.022.201802.369-382

Soboleva et al., 2018 – *Soboleva, E.V., Sokolova, A.N., Votinceva, M.L.* (2018). Model' kognitivnoj deyatel'nosti v cifrovoj srede tekstovogo labirinta Quandary [A model of cognitive activity in the Quandary text labyrinth digital environment]. *Perspektivy Nauki i Obrazovaniya*. 5(35): 221-230. DOI: https://doi.org/10.32744/pse.2018.5.25 [in Russian]

Soboleva, Perevozchikova, 2019 – *Soboleva, E.V., Perevozchikova, M.S.* (2019). Features of training future teachers to develop and use mobile gaming applications with educational content. *Perspektivy nauki i obrazovania*. 41(5): 428-440. DOI: http://dx.doi.org/10.32744/pse.2019.5.30

Strategiya razvitiya..., 2017 – Strategiya razvitiya informacionnogo obshchestva v Rossijskoj Federacii na 2017–2030 gody [Strategy of the Information Society Development in the Russian Federation for 2017–2030]. 2017. [Electronic resource]. URL: http://www.kremlin.ru/acts/bank/41919 [in Russian]

Terzidou et al., 2018 – *Terzidou, T., Tsiatsos, T., Apostolidis, H.* (2018). Multimed Architecture and interaction protocol for pedagogical-empathic agents in 3D virtual learning environments. *Multimedia Tools and Applications*. 77: 27661. DOI: https://doi.org/10.1007/s11042-018-5942-4

Testometrika – Testometrika. Psychological tests online. [Electronic resource]. URL: https://testometrika.com/ [in Russian]

teWierik et al., 2015 – *teWierik, M.L.J., Beishuizen, J., van Os, W.* (2015). Career guidance and student success in Dutch higher vocational education. *Studies in Higher Education*. 40(10): 1947-1961. DOI: https://doi.org/10.1080/03075079.2014.914905

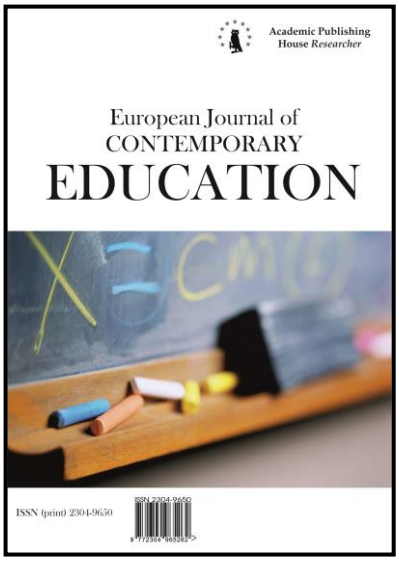
Uchoba – Uchoba.RU. Catalog of educational institutions and programs in Russia and abroad. [Electronic resource]. URL: https://www.ucheba.ru/ [in Russian]

Varshavskaya, Kotyrlo, 2019 – *Varshavskaya, E., Kotyrlo, E.S.* (2019). Graduates in Engineering and Economics: Between Demand and Supply. *Voprosy Obrazovaniya*. 2: 98-128. DOI: https://doi.org/10.17323/1814-9545-2019-2-98-128

Zeer, Popova, 2015 – *Zeer, E.F., Popova, O.S.* (2015). Psychological guiding of students' individual educational trajectories in vocational school. *The Education and science journal*. 1(4): 88-99. DOI: https://doi.org/10.17853/1994-5639-2015-4-88-99

Zhurkina et al., 2016 – *Zhurkina, A.Ya., Sergushin, E.G., Sergushina, O.V.* (2016). Teoreticheskie aspekty social'no-professional'nogo samoopredeleniya uchashchihsya obrazovatel'nyh organizacij [Theoretical aspects of social and professional self-determination of students of educational organizations]. *Integraciya obrazovaniya*. 20(1): 29-36. DOI: https://doi.org/10.15507/1991-9468.082.020.201601.029-036 [in Russian]

Published in the Slovak Republic
European Journal of Contemporary Education
E-ISSN 2305-6746
2020, 9(3): 621-633
DOI: 10.13187/ejced.2020.3.621
www.ejournal1.com



The Influence of the Type of Secondary School and the Weekly Allocation of Informatics on Results of Students' Achievements in Computer Science – Case Study

Daniela Šusteková [a, *], Lýdia Kontrová [a], Vladislav Biba [a]

[a] Departement of Informatics, University of Žilina, Slovakia

Abstract

The level of students coming to the University of Žilina is very different. There are significant differences in the level of knowledge from secondary schools, in the way of study, in the approach to the responsibilities and, last but not least, in the pursuit of new knowledge. Many students have difficulties integrating fully into the study process and are having problems to master the study of the first year. Therefore, research was conducted to find out what is the big difference between students, which is affecting their achievements. The article describes the results of the research done at the Faculty of Operation and Economics of Transport and Communications of the University of Žilina. There were several research objectives. The first goal was to find out the impact of the type of secondary school on the results of the study at the university from the subjects of Informatics in both semesters. The second objective was to find out how the number of hours in the subject of informatics weekly attended at secondary school affects the grade from Informatics at the faculty. The third goal was to compare study results in both semesters. To obtain the results was used the One-Factor Variance Analysis Method, T-Test for Two-Sample Assuming Unequal Variances, t-Test Paired Two Sample for Means.

The research showed that the type of secondary school influences the study results in both semesters.

Another interesting fact was that students who had a lot of informatics in secondary school do not achieve better results than those who have much less of Informatics. The results of the 2nd semester show that some of the students have adapted to the situation, improved their learning outcomes and were able to move further to the next years.

Keywords: Informatics, the One-Factor Variance Analysis Method, T-Test for Two-Sample Assuming Unequal Variances, t-Test Paired Two Sample for Means.

* Corresponding author
E-mail addresses: sustek@fpedas.uniza.sk (D. Šusteková)

1. Introduction

Using information technologies (IT) is an indispensable trend in all areas of our life. At this time it is not possible to imagine any activity without up-to-date technologies and using IT has become an essential part of our lives. Working life requires the use of the computer by professionals in all areas. Therefore, it is necessary to include the subject of Informatics in the program for all levels of school education.

Informatics is a relatively new subject compared to mathematics. As a result, there has been much less research done in IT education.

Currently, there is no standard international agreement in OECD countries on the adopted framework for teaching informatics and information technology. Nevertheless, this issue has been discussed many times at different levels. Lack of research in this area makes it challenging to identify methods, forms and contents that are effective in teaching informatics.

The first concept of computer science teaching at schools in Slovakia in the 1970s, 1980s and early 1990s was based on the creation of algorithms and programming under the slogan "Programming, Second Literacy". In the early 1990s, schools were asked to teach students how to work with computers, namely to know the operating systems and the essential applications of word processing and spreadsheets. In the late 1990s, the teaching of the so-called modern computer science was launched. These included five essential topics – information about us, computer systems, algorithms and creating algorithms, areas of use of informatics and information society.

Textbooks and worksheets were created later for specific topics.

The educational content of Informatics for ISCED2 and ISCED3 (eg. [1], [2]) is currently divided into five areas:

- Information Around Us,
- Communication through IT,
- Procedures, Problem Solving, Algorithmic Thinking,
- Principles of IT functioning,
- Information Society.

Subjects at secondary schools are taught according to these areas. There are subjects such as Work with Applications, Office, Operating Systems, Computer-Networking Basics, Programming Basics and others. The level of teaching depends on the type and level of secondary school.

At the Faculty of Operation and Economics of Transport and Communications of the University of Žilina, the subject of Informatics is included in the first year in all study fields of full-time and part-time study. The course aims to develop knowledge of secondary school computer science and to stress out the use of computer capabilities as a tool for the implementation of information technology in profile professional applications. Teaching is oriented to gaining the knowledge that graduates need in their practice. Therefore, they were designed in such a way that graduates have the best chance of successfully passing the entrance tests before getting the job and become successful within their new positions.

The subjects of Informatics 1 and Informatics 2 have a practical and theoretical part. In the practical part of the lesson, some Office applications are practiced, where students will gain practical computer skills and essential knowledge to use any application they may encounter in practice.

The theoretical part of the first semester consists of teaching basic knowledge about personal computers such as personal computer hardware and basic principles of operating systems. In the second semester, the lessons are focused on computer networks, their principles and their functioning.

2. Materials and methods

In recent years were encountered several problems that affect not only the learning results but also the teaching process itself. Moreover, the problems have a negative impact on the professional quality of the lectured subject matter in exercises and lectures.

Teachers often meet with the inability of most students to work systematically throughout the term, which means:

- During the teachers' explanation, they do not concentrate on the subject matter explained as they are not able to focus on learning.

- Tasks in exercises are done only superficially.
- Students do not rely on their abilities and do not like it if the teacher asks them to try to perform the tasks themselves without help.

Another problem is studying for an exam. Many students are not interested in acquiring more profound knowledge. They are not interested in mastering the subject as best as possible. Most of the effort is spent on passing an exam, learning only basics and getting the grade from the exam.

One of the reasons may be narcissism, which is described and its consequences are explained in the article by the author M. Podzimek from 2019 in "Problems of narcissism in education: The culture of narcissism as a dangerous global phenomenon for the future". It is the narcissism observed in young people that can have undesirable effects both concerning studies but also in relation to authorities, i.e., university professors and teachers. It is a consequence of modern times (Podzimek, 2019).

Modernism, which appeared as a result of industrialization, has since then developed further, resulting in a postmodern society, characterized by a significant change in values. This shift in values is particularly evident in the quality of education, and man's subsequent relation towards work as a result. Schools have become social institutions in which learners spend their time in the role of served clients. The teacher is therefore assigned the social role of the servant, in which he is to satisfy the pupil in his personal needs primarily. This kind of relationship stems from the phenomenon of narcissism, which is already a cultural phenomenon (Podzimek, 2019: 489).

Furthermore, it can be one of the problems why students in schools do not have such quality results as they can achieve based on their prerequisites.

Another reason why some students have difficulty in studying at a university may be the Massification of higher education that means, that university also accepts students who should not have studied at all at the university some decades ago, now they can attend universities and also the curriculum is too challenging for them. As mentioned in the article of K. Vančíková however, the massification of higher education is a natural response of society to the new demands of the era and it is logical to assume that by the end of the 21st century the vast majority of the population will have higher education. Slovakia lags behind the OECD and EU average in this indicator. The issue is not how many students head towards higher education but what programs they are heading for. Massification is a problem or challenge for university education worldwide, as evidenced by the authors' work of Deane E. Neubauer, D., E., Ka Ho Mok, Jin Jiang in work "The Sustainability of Higher Education in an Era of Post-Massification. Series: Routledge Critical Studies in Asian Education". The book researches the sustainability of mass university education across the Asia-Pacific region and its consequences, challenges and particular country constraints. Over the last three decades, the massification of university education has been through in complex and in some cases overwhelming ways. Moreover, both universities and secondary schools must adapt their teaching programs to a new trend.

Probably the most significant change in the way of study has been brought by the Internet.

Interaction and Information technologies have reshaped our life today, and nowadays' students and teachers have massive use of smartphones, iPads and other portable devices; moreover, they are continually looking for cutting edge technologies (Alabdulkareem, 2018: 583).

The Internet is a phenomenon we cannot imagine our life and work without. This phenomenon has its pros and cons. Here is described some aspects of its negative influence on university studies.

- Impact of web pages on knowledge.
- The vast amount of information available to everyone and everywhere. It is difficult to determine which information is relevant and can be used as reliable.
- Mobile networks and connectivity to the Internet.
- It allows students to surf the Internet during lessons that distract their attention from gaining knowledge. It allows also cheating on exams to an extent which was never seen in history before.

Mentioned problems are less evident in certain groups of student. Teachers were interested in what may affect the achievement of students at universities.

Students at first filled in questionnaire in which they specified type of secondary school attended, number of Informatics lessons per week, location of secondary school etc. Out of these

information and expertise of university teachers there were main areas of research determined – how the type of secondary school and the number of lessons of informatics weekly affects the results of the subject Informatics at the university. The article describes verifying the following research issues:

- Whether and to what extent can type of secondary school influence sudents' 1st semester study results in the subject Informatics 1.
- The impact of the number of lessons per week in secondary school on the grade from the subjects of Informatics 1.
- Whether and to what extent can type of secondary school influence their 2nd semester study results in the subject Informatics 2.
- The impact of the number of lessons per week in secondary school on the grade from the subject of Informatics 2.
- Grades of both semesters. Whether there is improvement during second term, whether students learned to work more effectively during classes, to look out and study from literature and to prepare for successful passing of the exam.

3. Results

3.1. Data Analysis – the 1st Semester

Verifying following research issues – Whether and to what extent can type of secondary school influence their 1st year study results in the subject Informatics 1.

Secondary schools were divided into three categories according to the type of secondary schools in Slovakia:

Grammar School
Business Academy
Secondary Technical School

To study research issues, there were used the grades of 290 students and average grade from an IT exam was calculated for every type of secondary school. This shows that a type of secondary school affects students' results at university (Table 1).

Table 1. The Average Grade in the Informatics1 Exam according to the Type of School

Grammar School	3,11224
Business Academy	3,69474
Secondary Technical School	3,9596

For statistical evaluation of the results obtained in the experiment, was used one – factor variance analysis (Tirpáková, 2011). It was expected that the level of the mean of three primary complexes depends on one factor – type of secondary school (Table 2).

Therefore the research group was divided into three groups: 98 students from Grammar Schools, of 94 students of Business Academies and the third group was consisted of 98 students from Secondary Technical Schools from all over Slovakia and other European countries. The decision factor in the selection of research subjects was the agreement in the following relevant indicators:

Use of identical teaching materials, agreement in the time-thematic plans and the same lesson allocation for the subject of Informatics.

Verification of each hypothesis proceeded according to separate experimental plan.

Number of observations $N = 290$. The values of the observed X were sorted into three groups with unequal numbers of observations, where $n_1 = 98, n_2 = 94, n_3 = 98$.

To apply statistical method of one – factor dispersion there were analysis three conditions necessary:

Selected samples come from basic complexes with normal division, selected samples are independent and dispersions of basic complexes are equal.

The observed character X denoted the level of students' knowledge reached in the subject Informatics1. Measured values represent the realization of mutually independent and random

selections from the basic complexes, in which the observed sign X has a normal division $N(\mu_1, \sigma_1^2)$, $N(\mu_2, \sigma_2^2)$, $N(\mu_3, \sigma_3^2)$.

μ1 denotes the average level of students' knowledge from Grammar Schools,

μ2 denotes the average level of students' knowledge from Business Academies,

μ3 denotes the average level of students' knowledge from Secondary Technical Schools.

To verify the first condition – the selected samples come from the basic sample with normal division – was used Shenton-Bowman test. The test confirmed the normality of selective complexes.

Second condition – the selected samples are independent, was accomplished in relation to the construction of random variables during our pedagogical experiment.

For the verification of the third condition – the dispersions of basic samples are equal – we used the Von Neumann test for the equality of dispersions.

We denoted n_1, n_2, n_3 the size of the samples and S_1^2, S_2^2, S_3^2 variance of the samples. Let $n_1 + n_2 + n_3 = N$. The testing statistics of the Von Neumann test for testing the null hypothesis Ho: The dispersions of basic sample are the same, versus to H1: the dispersions of basic samples are different has the form:

$$L = -\sum_{i=1}^{3} n_i \cdot ln\frac{S_i^2}{S^2}; \quad S^2 = \frac{1}{N}\sum_{i=1}^{3} n_i S_i^2.$$

The verified hypothesis Ho is rejected at the significance level $\alpha = 0{,}05$, if the value of tested criterion $L \geq \chi^2_{0,05}(2)$. $\chi^2_{0,05}(2) = 5{,}991$ is the tabulated critical value for $k = 2$. The value of the testing characteristics $L = 1{,}028$. Hypothesis Ho is not rejected at the significance level $\alpha = 0{,}05$. The assumption of the equality of dispersions for all three basic samples has been proved.

After the verification of conditions a) – c) we proceeded to the one – factor analysis of variance for unbalanced attempt as the compared samples have normal dispersion and the dispersions of basic samples are equal.

Tested hypothesis: H_0: $\mu_1 = \mu_2 = \mu_3$ versus to the alternative hypothesis H_1 : Not all μ_i are equal providing the dispersion equality $\sigma_1^2, \sigma_2^2, \sigma_2^2$. The calculation was realized in the MS Excel program for the ANOVA function for the significance level α = 0,05. The output table of the one-factor analysis of variance consists of two parts; the values of descriptive characteristics of specific factor levels are calculated in the first part (size of the samples, average and dispersion of the samples).

The second part contains total sum of squares (SS), the numbers of degrees of freedom (df), the mean square of variance (MS), the value of testing criteria $F = 9{,}382641$ and the critical value $F_{crit}\ (2{,}287) = 3{,}027221$.

As $F > 3{,}0272$ is valid, we reject the H_0 hypothesis at the significance level $\alpha = 0{,}05$, which means that level of students' knowledge from different schools A, B, C are significantly different.

The same result is obtained by the use of the value $Value\ P$. As the value $P = 0{,}000113$, the value of error we get if the null hypothesis is rejected is approximately 0,011 %, which is allowable error rate at the significance level $\alpha = 0{,}05$ (Table 1).

Table 2. Anova Single Factor

Anova: Single Factor						
SUMMARY						
Groups	Count	Sum	Average	Variance		
Column 1	98	305	3,112245	2,203766042		
Column 2	94	346	3,680851	1,875543354		
Column 3	98	388	3,959184	1,750894172		
ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	36,48622	2	18,24311	9,382641431	0,000113	3,027221
Within Groups	558,0276	287	1,944347			
Total	594,5138	289				

Teachers were also interested in the fact, which two of three are significantly different in their effectiveness, for this problem was used Duncan's test for the statistical significance of contrasts. The average numbers of points were arranged according to their size, $\bar{x}_1 = 3{,}11$; $\bar{x}_2 = 3{,}68$; $\bar{x}_3 = 3$.

The value of tested criterion was calculated, given S_r^2 as a residual dispersion (1)

$$D_p = \frac{|\bar{x}_i - \bar{x}_j| \cdot \sqrt{2}}{\sqrt{\left(\frac{1}{n_i} + \frac{1}{n_j}\right) \cdot S_r^2}}; \qquad p = 2{,}3.$$

The relevant tables were used for the determination of critical values of Duncan's test $D_{0,05}$ for the significance level $\alpha = 0{,}05$ for given p and given residual number of degrees of freedom $290 - 3 = 287$. These data were entered into the Table 3 together with the calculated values $D_{p,\alpha}$.

By means of these characteristics, was tested the statistical significance of the particular arithmetic averages (Šusteková, Kontrová, 2019).

Table 3. The Critical Values of Duncan's Test

p	$D_{p,critic}$	i, j	$D_{p,0,05} = \frac{\lvert\bar{x}_i - \bar{x}_j\rvert \cdot \sqrt{2}}{\sqrt{\left(\frac{1}{n_i} + \frac{1}{n_j}\right) \cdot S_r^2}}$
2	2,772	$i = 1, j = 2$	4,24
2	2,772	$i = 2, j = 3$	2,08
3	2,91	$i = 1, j = 3$	6,32

The results between the first and second sample: $p = 2, D_{2,\alpha} = 4{,}24$: $D_{2,\alpha} > D_{2,critic}$ thus differentia is significant, the results between the second and third sample: $p = 2, D_{2,\alpha} = 2{,}08$; $D_{2,\alpha} < D_{2,critic}$ thus differentia is not significant.

Results between the first and third sample: $p = 3, D_{3,\alpha} = 6{,}32$; $D_{3,\alpha} > D_{3,critic}$ thus differentia is significant.

Result: There is a significant difference in learning outcomes between Grammar School and Business Academy and Grammar School and Secondary Technical School.

Business Academy and Secondary Technical School do not have a significant difference.

The results show that students from Grammar Schools are best prepared for studies.

Verifying following research issues – Whether students with a higher number of lessons in computer science than two hours weekly (group 1) in a secondary school achieved better results in the Informatics 1 than students whose lesson allocation was equal or less than 2 lessons per week (group 2).

The study results are pointing out that the number of computer science lessons per week at secondary schools does not affect the learning results. It is shown by the average grades of both student groups (Table 4).

Table 4. The Average Grade in the Exam Informatics1 according to the Number of Hours of Computer Science Lessons in a Secondary School per Week

Number of hours per week > 2	3,568627451
Number of hours per week <= 2	3,675675676

Based on the formulation of the experiment's aim the following hypothesis was set:

H_1: The students with more than two lessons of computer science per week at a secondary school achieved better results in the Informatics1 exam than the students whose lesson allocation was less than 2 hours per week.

To verify the hypothesis H_1, was selected a significance level $\alpha = 0,05$. There were compared two groups of data: in the first set, there were results from the examination of students with higher allocation.

There were two independent samples n = 36, m = 255. With the sample characteristics by using T – test. It was found out that the difference between their distributions is not statistically significant. For this reason was tested the difference between the two groups by a two-sample location Student's t-test with equal distribution.

There was tested the hypothesis H0: $\mu_1 = \mu_2$ versus H1: $\mu_1 \neq \mu_2$

The value of test statistics is T = 0,26018 and p = 0,7949.

After comparing it with the critical values of a t-test were obtained:

$T = 0,2601 < t_{0,05}(289) = 1,9682$.

The H0 hypothesis was not rejected. The selective average on the selected significance level does not differ from the value of the average of the basic file (Šusteková, Kontrová, 2019).

Table 5. Results of T-Test Two-Sample Assuming Equal Variances

t-Test: Two-Sample Assuming Equal Variances		
	Variable 1	Variable 2
Mean	3,638888889	3,57254902
Variance	2,408730159	2,001605682
Observations	36	255
Pooled Variance	2,050911414	
Hypothesized Mean Difference	0	
df	289	
t Stat	0,260181256	
P(T<=t) One-Tail	0,397454616	
t Critical One-Tail	1,650143229	
P(T<=t) Two-Tail	0,794909233	
t Critical Two-Tail	1,968206436	

The results of the statistical analyses did not confirm our expectations. There were obtained the following results: Students with a higher number of lessons in computer science than two lessons (group1) a week at a secondary school do not achieve better results in the Informatics 1 exam than students whose lesson allocation was equal or less than 2 hours a week (group 2).

3.2. Data Analysis – the 2nd Semester

In the second semester, research was conducted on a sample of 182 students participating in the exam. These are the same students as in the first semester, but the number is lower because some students have dropped out early and some have failed the exam.

Verifying following research issues – Whether and to what extent can type of secondary school influence their 1st year study results in the subject Informatics 2.

Table 6 shows that the order of success of students according to secondary schools is the same as in the first semester, i.e., the best is Grammar School, then Business Academy and then Secondary Technical School.

Table 6. The Average Grade in the Informatics2 Exam according to the Type of School

Grammar School	2,38
Business Academy	2,778
Secondary Technical School	2,932

For statistical evaluation of the results obtained in the experiment, was used one – factor variance (Tirpáková, 2011). It was expected that the level of the mean of three basic complexes depends on one factor – the type of secondary school (Table 7).

Table 7. Anova Single Factor

Anova: Single Factor						
SUMMARY						
Groups	Count	Sum	Average	Variance		
5	85	203	2,388235	1,454622		
4	17	48	2,773529	1,404412		
5	88	258	2,931818	1,604493		
ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	13,16606	2	6,583028	4,330791	0,014502	3,04424
Within Groups	284,2497	187	1,520052			
Total	297,4158	189				

Because the $F > 3{,}0272$ is valid, the H_0 hypothesis was reject at the significance level $\alpha = 0{,}05$, which means that the level of students' knowledge from different schools A, B and C are significantly different.

The same result is obtained by the use of value Value P. As the value $P = 0{,}014502$, the value of error was get if the null hypothesis is rejected and it is approximately 1,45 %, which is allowable error rate at the significance level $\alpha = 0{,}05$.

Duncan's test was used for the statistical significance of contrasts again. The average numbers of points were arranged according to their size.

$$\bar{x}_1 = 2{,}38; \qquad \bar{x}_2 = 2{,}77; \qquad \bar{x}_3 = 2{,}93.$$

The value of tested criterion was calculated, given S_r^2 as a residual dispersion (2).

$$D_p = \frac{|\bar{x}_i - \bar{x}_j| \cdot \sqrt{2}}{\sqrt{\left(\frac{1}{n_i} + \frac{1}{n_j}\right) \cdot S_r^2}}; \qquad p = 2{,}3.$$

The relevant tables were used for the determination of critical values of Duncan's test $D_{0,05}$ for the significance level $\alpha = 0{,}05$ for given p and given residual number of degrees of freedom 192-3 =189. These data were entered into the Table 8 together with the calculated values $D_{p,\alpha}$.

By means of these characteristics, there was tested the statistical significance of the particular arithmetic averages.

Table 8. The Critical Values of Duncan´s Test

p	$D_{p,critic}$	i, j	$D_{p,0,05}$
2	2,80	$i = 1, j = 2$	1,83
2	2,80	$i = 2, j = 3$	0,73
3	2,95	$i = 1, j = 3$	4,27

The results between the first and second sample: $= 2$, $D_{2,\alpha} = 1{,}83$;
$D_{2,\alpha} < D_{2,critic}$ thus differentia is not significant.
The results between the second and third sample: $\mathbf{p} = 2$, $D_{2,\alpha} = 0{,}73$;
$D_{2,\alpha} < D_{2,critic}$ thus differentia is not significant.
The results between the first and third sample: $= 3$, $D_{3,\alpha} = 4{,}27$;
$D_{3,\alpha} > D_{3,critic}$ thus differentia is significant.

Result: There is a significant difference in learning outcomes between Grammar School and Secondary Technical School. However, there is no significant difference between Grammar School and Business Academy and between Business Academy and Secondary Technical School.

The results of the second semester also confirm that Grammar School students are best prepared for the studies at the university.

Verifying following research issues – Whether students with a higher number of lessons in computer science than two hours weekly (group 1) in a secondary school achieved better results in the Informatics 2 than students whose lesson allocation was equal or less than 2 lessons per week (group 2).

The study results are pointing out that the number of computer science lessons per week at secondary schools does not affect the learning results of Informatic 2. It is shown by the average grades of both student groups (Table 9).

Table 9. The Average Grade in the Exam Informatics2 according to the Number of Hours of Computer Science Lessons in a Secondary School per Week

Number of hours per week > 2	2,67
Number of hours per week <= 2	2,55

Evaluating the hypothesis statistically by T-Test for Two-Sample Assuming Unequal Variances with two independent samples n = 75, m = 118. For this reason there was tested the difference between the two groups by a two-sample location Student's t-test with unequal variances. There was tested the hypothesis H0: $\mu_1 = \mu_2$ versus H1: $\mu_1 \neq \mu_2$.

Results were in Excel file (Table 10).

Table 10. Results of T-Test Two-Sample Assuming Equal Variances

t-Test: Two-Sample Assuming Unequal Variances		
	Variable 1	Variable 2
Mean	2,76	2,52991453
Variance	1,536216216	1,47539051
Observations	75	118
Hypothesized Mean Difference	0	
df	156	
t Stat	1,264796754	
P(T<=t) One-Tail	0,103915192	
t Critical One-Tail	1,654679996	
P(T<=t) Two-Tail	0,207830384	
t Critical Two-Tail	1,975287508	

The value of test statistics is t = 1,2647 and P = 0,1039. When comparing it with the critical values of a t-test were obtained: t = 1,264 < $t_{0,05}(183)$ = 1,975.

The H0 hypothesis was not rejected. The selective average on the selected significance level does not differ from the value of the average of the basic file.

Comparison of Results after Passing the Subjects of Informatics 1 and Informatics 2

This section evaluates the results of the exams Informatics 1 and Informatics 2 of the 1st year of study. The aim was to find out how the student's results changed in the 2nd semester, the method used for this evaluation was t-Test: Paired Two Sample for Means (Table 11).

Table 11. t-Test: Paired Two Sample for Means

	1. sem.	2. sem.
Mean	2,653846154	3,417582418
Variance	1,641946451	2,178252687
Observations	182	182
Pearson Correlation	0,240451907	
Hypothesized Mean Difference	0	
df	181	
t Stat	-6,03919081	
P(T<=t) one-tail	4,29592E-09	
t Critical one-tail	1,653315758	

There was set up and tested the hypothesis:

H0 – the results in the 1st semester and 2nd semester are identical

compared to the hypothesis of

HA – the results in the 2nd semester are on average better compared to those in the 1st semester.

There was used t-Test: Paired Two Sample for Means.

The P-value of the test is approximately 4.3E-9; therefore, the hypothesis H0 was rejected and thus, HA is valid.

Thus, it has been shown that the student results in the second semester were significantly better than in the first semester. This confirmed the assumptions of the teachers who observed a significant improvement in the second semester lectures. Students work harder in exercises and lectures and communicate much more with educators and teachers.

4. Results

The first research issue was: Whether and to what extent can the type of secondary influence their 1st year study results in the subject Informatics 1?

Following results were achieved:

There is a significant difference in learning outcomes between Grammar School and Business Academy, and Grammar School and Secondary Technical School. Business Academy and Secondary Technical School do not have a significant difference in learning outcomes. It means that students from Grammar Schools are best prepared for university studies.

The second research issue was: Whether students with a higher number of lessons in computer science than two hours weekly in a secondary school achieved better results in the Informatics 1 than students whose lesson allocation was equal or less than 2 lessons per week.

There were obtained the following results: Students with a higher number of lessons in computer science than two lessons a week at a secondary school do not achieve better results in the Informatics 1 exam than students whose lesson allocation was equal or less than 2 hours a week.

The third research issue was: Whether and to what extent can type of secondary school influence their 1st year study results in the subject Informatics 2.

The results of the research demonstrated that is a significant difference in learning outcomes between Grammar School and Secondary Technical School. However, there is no significant difference between Grammar School and Business Academy and between Business Academy and Secondary Technical School. The results of the second semester also confirm that Grammar School students are best prepared for the studies at the university.

The fourth research issue was: Whether students with a higher number of lessons in computer science than two hours weekly at a secondary school achieved better results in the Informatics 2 than students whose lesson allocation was equal or less than 2 lessons per week.

It was confirmed – students of both samples had almost the same results.

The fifth research was set up and tested the hypothesis:

H0 – the results in the 1st semester and 2nd semester are identical.

compared to the hypothesis of

HA – the results in the 2nd semester are on average better compared to those in the 1st semester.

Grades in the 2nd semester shows that students consecutively get used to university load, they find the way to learn and work sufficiently so they are able to fulfill studying demands.

5. Discussion

Informatics is taught in schools only shortly. In the 1980's and the 1990's, IT education was implemented in many countries (Diethelm, Mittermeir, 2013) and due to the dynamics of IT development the curriculum of this subject often changes and therefore the results of research in teaching informatics are so far rare, despite the fact that good IT knowledge will become more and more important in the future. Teaching informatics has become important to successful study at university in many scientific disciplines and can essentially contribute to the success of young people in their working future (Hromkovič, Björn, 2011).

The research described in the article will serve as a basis for further progress in the teaching of Informatics at the PEDAS Faculty of the University of Žilina. Such research has never been done at the faculty It is unique and all its results are important for teachers.

The research points out that study results of university students are to a large extent influenced by a quality and type of a secondary school. Difference in the grades from both semesters are significantly better in favor of Grammar Schools which prepare students for studies at universities and graduates of these schools have better results in year-end tests compared to students from other schools (Tunega, 2019).

Secondary school students acquire not only knowledge but also learning habits that influence them especially at the beginning of their university studies (Šusteková, Kontrová, 2019).

Next important goal of the research was to find out whether more than two hours a week allocation of computer science lessons at secondary school leads to better outcomes in the subject Informatics at the university. The results of the students of both groups were comparable. Why is it like that? Students who had more than two hours a week allocation of computer science lessons in the first semester underestimated the subject, learned less and mastered the subject only with difficulties.

Another result of the research was encouraging for teachers – a comparison of the results obtained in 1st and 2nd semester.

The results of students in the second semester were significantly better than in the 1st semester, which indicates that the students learned to work systematically during the 1st semester and got used to the load of university curriculum. This was to a large extent supported by the approach of teachers.

According to university teacher's experiences, students in general don't have sufficient knowledge as well as studying habits. For example chancellor of Slovak Technical University decided to launch "zero year" which should prepare secondary school graduates for study at their university. It would be desired if secondary schools increase demands on teachers what will result in better quality of these schools. The teachers are most important. It is needed to have superior and devoted teachers and the education will improve (Mokošová, 2020).

In recent years were encountered several problems that affect not only the learning results but also the teaching process itself. More authors have addressed this issue. As was described in more detail in the Materials and methods of this article, one of the reasons may be narcissism (Podzimek, 2019: 489), which is a direct consequence of modernism as a result of industrialization.

According to (Twenge, Campbell, 2009), narcissism promotes false self-confidence in young people, which is not based on real knowledge and skills and can be a barrier to acquiring knowledge.

S. Alabdulkareem points to the massive use of devices connected to the Internet. These can detach students from the study and cause a number of problems such as inattention during class, cheating during the exam, the impact of web pages on knowledge and more (Alabdulkareem, 2018: 583).

Another reason why some students have difficulties in studying at a university may be the massification of higher education. As mentioned in the article of K. Vančíková (2019) however, it is a natural response of society to the new demands of the era and it is logical to assume that by the end of the 21st century the vast majority of the population will have higher education. It is a problem or challenge for university education worldwide, as evidenced by the authors' work of Deane E. Neubauer, D., E., Ka Ho Mok, Jin Jiang (2017).

5.1. Limitation

5.2. Among the selected groups (a total of 291 students), there were only 36 those who had more than 2 hours a week allocation of subject computer science, so the selections of the number of students in terms of statistical testing are very different.

Were used a two-sample t-test assuming equal variances for testing. The prerequisites for this test are data normality and the same variances for both selected groups. When these circumstances are met, the test is very resistant to different numbers of samples, e.g. in (Nist/Sematech, 2013) it is stated with the difference in the number of selections close to our case. (Alternatively, it would be possible to use the Welch t-test for different variances (Lyócsa et al., 2013), which has even fewer assumptions but similar strength).

5.3. The results of the survey serve to improve the teaching of Informatics at the PEDAS Faculty at the University of Žilina. For this reason, the area is limited to the faculty.

6. Conclusion

The research was done to analyze next main aims:

- Whether and to what extent can the type of secondary school influence the results of students in the subject Informatics in the 1st year of university study.
- Whether students with a higher number of lessons in computer science than two hours weekly achieved better results in the Informatics in the 1st year of university study.
- Comparison of Results after Passing the Subjects of Informatics 1 and Informatics 2.

These aims were deeply elaborated and divided in 5 more research issues in previous parts of the document.

The results show that students from Grammar Schools are best prepared for university studies in both semesters. Students with a higher number of lessons in computer science than two lessons a week at a secondary school do not achieve better results in the Informatics1 exam than students whose lesson allocation was equal or less than 2 hours a week in both semestres.

Grades in the 2nd semester shows that students consecutively get used to university load, they find the way to learn and work sufficiently so they are able to fulfill studying demands.

The results of the survey serve to improve the teaching of Informatics at the PEDAS Faculty at the University of Žilina and will be used to create the syllabus of this subject for future accreditation.

References

Alabdulkareem, 2018 – *Alabdulkareem, S.* (2018). Social media in education: The absent attendee. *Problems of Education in the 21st century*. 76(5): 583-586.

Diethelm, Mittermeir, 2013 – *Diethelm, I., Mittermeir, R.* (2013). Informatics in Schools. *6th International Conference on Informatics in Schools: Situation, Evolution, and Perspectives, Proceedings.*

Hauser, 2008 – *Hauser, J.* (2008). Štátny vzdelávací program pre 2. stupeň základnej školy v slovenskej republike , isced 2 – nižšie sekundárne vzdelávanie [State education program for 2nd stage of the elementary school in Slovak Republic, isced 2 – lower secondary education]. [Electronic resource]. URL: http://www.statpedu.sk/sk/filemanager/download/42 [in Slovak]

Hauser, 2008 – *Hauser, J.* (2008). Štátny vzdelávací program pre gymnáziá v slovenskej republike, "isced 3a – vyššie sekundárne vzdelávanie [State education program for grammar schools in Slovak Republic, isced 3a – higher secondary education]. [Electronic resource]. URL: http://www.statpedu.sk/sk/ filemanager/download/43 [in Slovak]

Hromkovič, Björn, 2011 – *Hromkovič, J., Björn, S.* (2011). Why Teaching Informatics in Schools Is as Important as Teaching Mathematics and Natural Sciences. In: lecture notes in computer science. Book series. Publisher Springer.

Lyócsa et al., 2013 – *Lyócsa, Š., Baumöhl, T., Výrost, T.* (2013). Kvantitatívne metódy v ekonómii II (Quantitative methods in economics II). Košice, Elfa.

Mokošová, 2020 – *Mokošová, Z.* (2020). New chancellor of Slovak Technical University: We offer students a year to teach them a secondary school curriculum.

Neubauer et al., 2017 – *Deane E. Neubauer, D., E., Ka Ho Mok, Jin Jiang* (2017). The Sustainability of Higher Education in an Era of Post-Massification. Series: Routledge Critical Studies in Asian Education, Monografia. London.

Nist/Sematech, 2013 – Nist/Sematech e-Handbook of Statistical Methods, 2013. DOI: https://doi.org/10.18434/M32189

Nový rektor STU… – Nový rektor STU: Študentom ponúkame rok, aby sme ich doučili učivo zo strednej. [Electronic resource]. URL: https://www.stuba.sk/sk/novy-rektor-stu-studentom-ponukame-rok-aby-sme-ich-doucili-ucivo-zo-strednej-dennikn.sk.html?page_id=13071. Dennikn, Bratislava. [in Slovak]

Podzimek, 2019 – *Podzimek, M.* (2019). Problems of narcissism in education: The culture of narcissism as a dangerous global phenomenon for the future. *Problems of Education in the 21st century*. 77(4): 489-501.

Šusteková, Kontrová, 2019 – *Šusteková, D., Kontrová, L.* (2019). How are high schools graduates prepared for informatics at university. *Proceedings of 12th annual International Conference of Education, Research and Innovation*. 4714-4720. Seville, Spain.

Tirpáková, 2011 – *Tirpáková, A.* (2011). Mathematics statistics, Monography. Nitra/Slovakia.

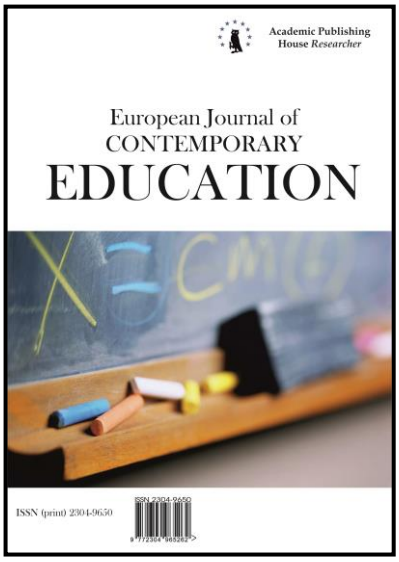
Tunega, 2019 – *Tunega, M.* (2019). Pozrite si aktuálne výsledky žiakov základných a stredných škôl [See the current results of primary and secondary school students]. [Electronic resource]. URL: http://www.ineko.sk/clanky/pozrite-si-aktualne-vysledky-ziakov-zakladnych-a-strednych-skol [in Slovak]

Twenge, Campbell, 2009 – *Twenge, J.M., Campbell, W.K.* (2009). The Narcism epidemic. New York, Simon and Schuster.

Vančíková, 2019 – *Vančíková, K.* (2019). Readiness of secondary schools graduates for universities. To dá rozum. Bratislava. [Electronic resource]. URL: htps//analyza.todarozum/docs/432871001mr1a/

Zuhair et al., 2019 – *Zuhair, A., Nabil, S., Najati, A.* (2019). Teachers carrying out their Professional Roles as View of Zarqa Town's Teachers. *European Journal of Contemporary Education*. 8(4): 715-725. DOI: 10.13187/ejced.2019.4.715

Published in the Slovak Republic
European Journal of Contemporary Education
E-ISSN 2305-6746
2020, 9(3): 634-644
DOI: 10.13187/ejced.2020.3.634
www.ejournal1.com



Research of Educational Results of Subject-Profile Training of Bachelor's Education in the Field of Life Safety

Tatiana V. Vileyto [a, *], Alexandra A. Esipova [a], Evgeniya Y. Molodtsova [a], Elvira M. Rebko [a]

[a] Herzen State Pedagogical University of Russia, St. Petersburg, Russian Federation

Abstract

This article is devoted to the presentation of the results of four years experimental' work in the form of analysis of subject-profile training of bachelors of education in the field of life safety. The presented experience is based on the results obtained during the design and implementation of curricula 2015, 2016, 2017 and 2018 in the practice of implementing the main professional program of training Bachelors in Security education Life at the Faculty of Life Safe, Herzen State Pedagogical University of Russia.

The theoretical part is presented in the form of justification of the methodological basis for the development of subject-profile training through the following approaches to the organization of training of future teachers in the field of life safety: systemic, culturology, anthropological, integrative, synergetic, axiological, environmental.

The practical part of the description of the experiment includes: the essence and content of the design, which is presented in the form of substation modules subject-profile training of future teachers of life safety fundamentals and presented in the form of an annual analysis of the educational results of bachelors of education in the field of life safety for each educational module (Basics of military service, Human social security, Protection of the person in emergency situations, Safety of Life in the Technosphere, Fundamentals of medico-valeological knowledge, Fundamentals of psychological safety in emergency situations, Environmental safety).

The article presents the results of the annual analysis of the educational results of each academic year (stage) of subject-specific training, which was accompanied by the diagnosis of educational results. In constructing the analysis of educational results, the authors provided the following methods: – testing (parametric quantitative statistics, reflecting the level of theoretical knowledge of students in the subject-profile training); – solving a situational problem (reflects the ability of students to act in specified dangerous and emergency situations of various types);

* Corresponding author
E-mail addresses: vileyto@mail.ru (T.V. Vileyto), pr-oekt@mail.ru (A.A. Esipova), molod.eiu@mail.ru (E.Y. Molodtsova), elvira_rebko@mail.ru (E.M. Rebko)

– professional task for the construction of the educational process (reflects the ability to apply subject-specific knowledge of safety in the design of pedagogical activities).

The diagnostic results (2015, 2016, 2017 and 2018) are presented in a comparative table indicating the results obtained for each module according to the traditional state system of points from 3 to 5 points.

Keywords: higher pedagogical education, subject-profile training, the field of life safety, State Educational Standards Higher Professional Education.

1. Introduction

The theory and practice of development of higher pedagogical education in the field of life safety allows possible to speak about the multidimensional the phenomenon of life safety (Stankevich et al., 2017). Spiking as an integral subject area of knowledge, life safety is global in nature and needs constant transformation of scientific knowledge, including the system of subject-profile training of Bachelors of education in the field of life safety.

At the present time it becomes obvious that at the present stage of development of higher pedagogical education in the field of life safety there is a problem related to necessity of constant updating of the content part Subject-profile training of bachelors. According to S. Abramova, the orientation of higher pedagogical education in the field of life safety lags behind the requirements of the national security of Russia due to the fact that human activity is caused by the constant appearance of new dangers and threats (Abramova, 2014). At the same time, it becomes obvious that the emergence of new dangers and threats requires the development of new, more advanced methods and mechanisms for the protection of man, the natural environment, and, as a result, leads to an adjustment of the subject-specific content of bachelor education in life safety.

The genesis of higher pedagogical education in the field of life safety allows to assert that the essential role in the construction of basic professional educational programs has been made by State Educational Standards of Higher Professional Education (SES HPE) and Federal State Educational Standards of Higher Education (FSES HPE and FSES HE). Education in the field of life safety is no exception. The Federal State Educational Standard of Higher Education of the third generation 3 + (hereinafter FSES HE 3 +) (Aver'yanov, 1985) is of fundamental importance for the construction of the structure and content of the curricula.

Table 1. Standardization of higher pedagogical education in the field of life safety from the beginnings to the present day

Year	Standards of higher pedagogical education in the field of life safety
before 1994	Not exist
1995	SES HPE 030400 – specialist degree (physical and preliminary military training)
2000	SES HPE 033300 – specialist degree (health and Life Safety)
2005	SES HPE 033300 – specialist degree (health and Life Safety)
2005	SES HPE 540100 – bachelor's and master's degree (natural Science education): 540107 profile «Health and Life Safety», 540107 M
2009	FSES HPE 050100 – Pedagogical education B (bachelor level)
2010	FSES HPE 050100 – Pedagogical education M (master's degree level)
2011	FSES HPE 050100 – Pedagogical education B
2015	FSES HE 44.03.01, 44.04.01, 44.06.01 Pedagogical education (3+) (bachelor, master and postgraduate levels)
2016	FSES HE 44.03.05 Pedagogical education (3+) (bachelor level)
2018	FSES HE 44.03.01, 44.03.05, 44.03.01 Pedagogical education (3++) (bachelor and master levels)

Implementation of the FSES HE 3 + in educational practice of training Bachelors of Education was the beginning of experimental work on the development of subject-profile training of bachelors (direction 44.03.01 Pedagogical Education, Orientation (Profile) "Education in the field of Life safety"), implemented in the period from 2015 to 2018.

2. Materials and methods

The following theoretical and empirical methods were used to solve the problems of the study:

Theoretical methods: analysis of psycho-pedagogical, educational and methodical literature on the problem of research; analysis of normative-legal documentation and local normative-legal documents of the University; studying and generalization of pedagogical experience of construction and realization of educational plans and the basic professional educational programs of the educational field of life safety; modeling and design of curricula and basic professional educational programs; comparison; generalization.

Empirical methods: observation, questioning, pedagogical experiment.

Pearson's chi-square test is used for statistical data analysis.

The presented experience is justified by the results obtained during the design and implementation of curricula in 2015, 2016, 2017 and 2018 in the practice of the main professional program training of bachelors of education in the field of life safety at the faculty of life safety at Herzen State Pedagogical University of Russia. The experience in the implementation of the subject-profile training in 2017 was the most satisfying to the needs of the developers, therefore it is presented in the most detail as a reference for the FSES HE 3 + and was re-proposed for implementation when recruiting entrants in the next year.

The number of students under the bachelor's program (focus (profile) "Education in the field of life safety") was 1025 people (of which 268 students in 2015, 276 in 2016 and 481 in 2017/2018). For realization of disciplines (modules) and practice of subject-profile preparation on the basis of 2 groups of students, it is necessary to involve 34 scientific-pedagogical workers at 3.7 rates, including on part-time and on the base of civil law contract in order to attract highly specialized specialists to improve the quality of education in the field of life safety.

To compare the volumes allocated for the implementation of subject-profile training of bachelors (presented in credit units), we give a description of the data from the relevant curricula.

Table 2. Number of credits allocated for the study of subject-profile training modules in 2015–2018

Modules/years and number of credits	2015	2016	2017, 2018
Basics of military service	7	7	9
Human social security	18	20	21
Protection of the person in emergency situations	15	16	15
Safety of life in the Technosphere	14	14	15
Fundamentals of medical-valeological knowledge	17	17	24
Fundamentals of psychological safety in emergency situations	10	10	12
Environmental safety	-	-	15

3. Discussion and results

The concept of higher pedagogical education in the field of life safety, the most important components of which (apart from psycho-pedagogical and methodical preparation) are understanding the reasons and solutions to the key problems and dangers of the modern world, ability to see and analyze components of the Technosphere systems, possibilities and mechanisms of their interaction. In this regard, the development of subject-profile training is impossible on the one hand – without reliance on the rich heritage of the past, and on the other – without taking into account modern directions of education in the field of life safety, innovative processes in the world and domestic pedagogy and psychology, as well as without taking into account the methodological foundations and approaches to the content and organization of the learning process in a modern University.

As a methodological basis for the development of subject-profile training we considered the following approaches: systemic, culturology, anthropological, integrative, synergetic, axiological, environmental (Abramova, 2014; Aver'yanov, 1985; Afanas'ev, 1980; Blauberg, 1975; Federal'nyi gosudarstvennyi obrazovatel'nyi standart; Gaisina, 2002; Gundyreva, Gundyrev, 2007; Mikhailov, 2003; Novikov, 2005; Solomin i dr., 2011).

The system approach acts as one of the fundamental approaches in the pedagogical theory and practice of teaching. Studied and described in detail by V.G. Afanasyev, A.I. Averyanov, I.V. Blauberg, V.I. Sadovsky, E.G. Yudin, etc. With regard to the problem of determining the content of subject-profile training in the field of life safety, it is expressed by the relationship and interdependence of man, nature and society in the co-adaptive and co-evolutionary relationships between them (Afanas'ev, 1980; Blauberg, 1975; Federal'nyi gosudarstvennyi obrazovatel'nyi standart; Gaisina, 2002; Gundyreva, Gundyrev, 2007; Zagvyazinskii, 2008).

The cultural approach is focused on the preservation and development of the continuity of the values of safety culture and health of the person. According to the concept of cultural approach to the formation of the content of education (M.N. Skinkin, I.J. Lerner, V.V. Kraevsky) the source of formation of the content of education is culture, that is the most important form of socio-cultural experience (Mikhailov, 2003; Novikov, 2005).

The anthropological approach binds together a complex of extensive knowledge about man (anthropology, humanitarian geography, biology, ecology, etc.), orients the education system to the knowledge of the natural and sociocultural factors of its development in systemic interaction with nature, society and one's own "I." O.V. Cherkasova emphasizes that the anthropological approach will allow us to look at the problem of human education in the complex (Solomin i dr., 2011).

The idea of integrative approach is reflected in all the content of the subject area of life safety, which is a highly integrated area of knowledge, and therefore in the development of curricula of the main professional Educational programs on similar training profiles (Federal'nyi gosudarstvennyi obrazovatel'nyi standart). Education in the field of life safety, implemented on the basis of this approach, is part of global education, based on interdisciplinary content, involves the integration of natural science and humanitarian areas of knowledge.

Synergetic approach allows us to study the fundamental properties of the system of the external world that allows to form the conceptual basis of integration of various scientific knowledge about safety and health protection around fundamentally new Methodology of cognition this forms the worldview and new ideas about the complex of dangers to man and society in conditions of instability on the planet, their causes and necessary security measures.

The axiological approach considers values as the most important component of material and spiritual culture of the person, implies its active activity position, humane attitude to life, health as values of higher order. Without this approach, it is impossible to create a culture of human security in which the need for security is fundamental, since it is impossible to realize both biological and social needs of the person (Cherkasova, 2019).

The noxological approach includes a set of principles, scientific concepts, methods of study, description, design, forecasting, transformation of objects of danger in order to take protective measures necessary to ensure the safety of man, society and nature (Yudin, 1978).

The ecological approach acts as one of the fundamental ones in shaping the bachelor's curriculum, and educating a person with an understanding of the material and spiritual values of nature as the basis of life on Earth, having personal experience in protecting the natural environment, and the need for careful communication with nature is a fundamental task of education at all levels.

Thus, it should be noted that as the basic approaches of formation of the educational plan of preparation of bachelors on a profile "Education in the field of life safety", we considered differentiation of all types of disciplinary and interdisciplinary training.

The structure of the variative part of disciplines consists of modules aimed at forming competencies for solving a group of tasks of professional activity. We consider it necessary to briefly present their content with an indication of the overall labor intensity, forms of control and the competencies that are being formed (according to the Federal State Educational Standard of Higher Education of the third generation 3 +).

Module 1 "Basics of military service" combines disciplines that focus on the study of topical issues related to the organizational and legal aspects of state defense and preparing young people for military service. Much attention is paid to practice-oriented issues of organization and training of young people in the field of state defense.

Table 3. Content of module 1 "Basics of military service"

№	Name of disciplines	Credit unit/hour	Forms of control	Competences
1.	Organizational and legal bases of preparation for military service	4/144	exam	GC-7; PC-3,6
2.	Basics of State Defense	3/108	exam	GC-2; PC-3,6
3.	Workshop on the basics of military service/Workshop on military sports games	2/72	credit	GC-2; PC-3,5
	Total	**9/324**		

Elective disciplines are highlighted in italics
Notes: PC – professional competencies
GC – general cultural competencies

Module 2 "Human social security" is focused on the study of modern problems of security of the person, society and the State and the most relevant aspects of behavior and culture of human security in society in the context of EMERGENCIES Social character. In the process of studying the module, students gain knowledge on various aspects of social security in the state.

Table 4. Content of module 2 "Human social security"

№	Name of disciplines	Credit unit/hour	Forms of control	Competences
1.	Emergency situations of social character and protection against them	4/144	exam	GC-7; PC-2,6
2.	Protection and preservation of cultural heritage	3/108	exam	PC-3
3.	Bases of counteraction to terrorism	3/108	exam	GC-7; PC-6
4.	Social security of the individual, society and state	2/72	credit	GPC-1; PC-3,5
5.	Culture of human security/Culture of safe behavior in society	2/72	credit	GC-9; PC-3
6.	Legal support of life safety/Organization providing life safety	5/180	exam	GC-7; PC-6
7.	Environika/ Anthropological risk factors	2/72	credit	GPC-1; PC-2,4
	Total	**21/756**		

Elective disciplines are highlighted in italics
Notes: PC – professional competencies
GPC – General professional competencies
GC – general cultural competencies

Module 3 "Protection of the person in emergency situations" unites disciplines which are focused on formation of competences in the field of protection of the person from emergency situations of various character. As a result of mastering the disciplines of this module, students acquire practical skills in the use of federal and regional life safety programs in their future professional activities.

Table 5. Content of module 3 "Protection of the person in emergency situations"

№	Name of disciplines	Credit unit /hour	Forms of control	Competences
1.	Fire safety	2/72	credit	PC-6,7
2.	Conceptual fundamentals of life safety	5/180	exam	GC-9; PC-4
3.	Federal and regional programs for life safety	5/180	exam	GC-7; PC-6
4.	Civil defense	3/108	credit	GC-2; PC-3,6
	Total	**15/1080**		

Notes: PC – professional competencies
GPC – General professional competencies

Module 4 "Safety of Life in the Technosphere" unites disciplines which are oriented on formation of competences in the field of safety in the Technosphere in conditions of increasing technogenic, natural and anthropogenic loading. The module examines the main problems of the modern world (demographic, food, energy, environmental, etc.), emergency situations of natural and technogenic character.

Table 6. Content of module 4 "Safety of Life in the Technosphere"

№	Name of disciplines	Credit unit /hour	Forms of control	Competences
1.	Emergency situations of natural character and protection against them	5/180	exam	GPC-6 PC-1,6
2.	Emergency situations of technogenic character and protection from them	4/144	diff. credit coursework	GC-9; PC-6,7
3.	Global problems of Mankind	3/108	exam	PC-3,6
4.	Noksology	3/108	exam	GC-9; PC-4
	Total	**15/540**		

Notes: PC – professional competencies
GPC – General professional competencies

Module 5 "Fundamentals of medico-valeological knowledge" is focused on the formation of professional competencies in the field of health-saving technologies and study of issues of healthy lifestyles of children and teenagers. This module is focused on the acquisition of practical-oriented knowledge and skills on the main aspects of medical-valeological education and social medicine. Introduces the peculiarities of age anatomy, physiology and hygiene of schoolchildren.

Table 7. Content of module 5 "Fundamentals of medico-valeological knowledge"

№	Name of disciplines	Credit unit /hour	Forms of control	Competences
1	Age anatomy, physiology and hygiene	5/180	exam	GPC-2; PC-2
2	Basic medical knowledge	4/144	Exam	GC-9; PC-1
3	Fundamentals of a healthy lifestyle	2/72	credit coursework	GPC-6; PC-6
4	Emergency Medicine	2/72	Credit	GC-6; PC -1
5	Social medicine	2/72	Credit	GC-5; PC -3
6	Psychophysiology of students /Workshop on the basics of medical knowledge	3/108	Credit	GPC-6; PC-2/ GPC-3; PC-11
7	Basics of medical and valeological education of children and adolescents/Basics of Pediatrics	3/108	Exam	GPC-6; PC-5/ GPC-2; PC-5
8	Human reproductive health/Fundamentals of spiritual and moral education of children and teenagers	3/108	Credit	GPC-5; PC-3
	Total	**24/864**		

Elective disciplines are highlighted in italics
Notes: PC – professional competencies
GPC – General professional competencies

Module 6 "Fundamentals of psychological safety in emergency situations" combines disciplines that are focused on the development and improvement of competencies for solving professional problems related to psychological safety of a person in the conditions of manifestation of various kinds of dangers.

Table 8. Content of module 6 "Fundamentals of psychological safety in emergency situations"

№	Name of disciplines	Credit unit/hour	Forms of control	Competences
1.	Fundamentals of psychological security and training in confronting a crisis influence	4/144	diff. credit	PC-2,6
2.	Psychological stability in emergency situations	2/72	diff. credit	PC-2,6
3.	Basis of psychological knowledge/ Fundamentals of victim behavior	3/108	exam	PC-5,6
4.	Fundamentals of research activity/Modern methods and technologies of diagnostics	3/108	diff. credit	PC-11,12/ PC-2,11
	Total	**12/432**		

Elective disciplines are highlighted in italics
Notes: PC – professional competencies

Module 7 "Environmental safety" is focused on the study of the main trends in the field of ecology and environmental management, biological, physical and geological phenomena and processes that form the modern image of the planet, as well as the study of geoecological threats and hazards, catastrophes in the historical context of planetary development.

Table 9. Content of module 7 "Environmental safety"

№	Name of disciplines	Credit unit/hour	Forms of control	Competences
1.	Biology with the basics of ecology	3/108	Exam	GC-3; PC-4,6
2.	Basics of nature management	3/108	diff. credit	GC-3; PC-4,6
3.	Global ecology	3/108	Exam	GC-9; PC-4,6
4.	Physical fundamentals of natural and technogenic phenomena/Physical fundamentals of safety	3/108	diff. credit	GC-3; PC-4
5.	Geo ecological catastrophes in the history of the Earth / Historical Geoecology	3/108	diff. credit	GC-9; PC-2,6
	Total	**15/540**		

Elective disciplines are highlighted in italics
Notes: PC – professional competencies
GC – general cultural competencies

The end of each academic year (stage) of subject-profile training was accompanied by diagnostics of educational results. In order to diagnose students in the study of the curriculum in the direction (profile) "Education in the field of life safety", we have provided the following methods:

- testing (parametric quantitative statistics, reflecting the level of theoretical knowledge of students in the subject-profile training);
- solving a situational problem (reflects the ability of students to act in specified dangerous and emergency situations of various types);
- professional task for the construction of the educational process (reflects the ability to apply subject-specific knowledge of safety in the design of pedagogical activities).

The diagnostic results of students (2015, 2016, 2017/2018) are presented in a comparative table indicating the results obtained for each module according to the traditional state system of points from 3 to 5 points. The research took into account the results of certification of 40 students of each year of study (a total of 120 people), grades were recorded for each type of assignment in each module.

Table 10. Comparative table of educational results

	2015			2016			2017/2018		
	Test	Situational problem	Professional task	Test	Situational problem	Professional task	Test	Situational problem	Professional task
Module 1	3,9	4,2	4,3	4,1	4,4	4,3	4,2*	4,4*	4,5*
Module 2	4,3	4,4	4,2	4,2	4,5	4,3	4,4*	4,5*	4,3*
Module 3	4,1	4,3	4,2	4,4	4,4	4,5	4,6*	4,7*	4,5*
Module 4	4,3	4,2	4,3	4,4	4,5	4,3	4,5*	4,5*	4,4*

Module 5	4,1	4,3	4,3	4,3	4,2	4,4	4,4*	4,3*	4,5*
Module 6	4,5	4,3	4,5	4,7	4,4	4,5	-	-	-
Module 7	4,3	4,4	4,3	4,5	4,5	4,4	4,5*	4,5*	4,4*

"*" – partially implemented
"-" – the module has not been studied yet

Because the traditional state system of five-point assessment gives data in a rank scale with a large number of equal ranks in one group of subjects, this leads to the impossibility of using the method of checking the statistical significance of the positive dynamics of the level of knowledge of students by traditional, in this case methods ANOVA and Kruskal — Wallis ANOVA.

Based on this, we decided to assess the significance of changes using the χ2 – Pearson's chi-square test. To do this, our data has been converted into tables of the correlation of indicators of the results of certification and the year of study of students (Table 11).

Table 11. The frequency of joint occurrence of the results of certification and the year of study of students

	Satisfactory	Good	Excellent
2015 academic year	$Nsat_{;15}$	$Ngood_{;15}$	$N_{exl;15}$
2016 academic year	$Nsat_{;16}$	$Ngood_{;16}$	$Nexl_{;16}$
2017/2018 academic year	$Nsat_{;17}$	$Ngood_{;17}$	$Nexl_{;17}$

Here: 2015 academic year, 2016 academic year, 2017/2018 academic year, – indicators of the factor trait of training in different content programs; Satisfactory, Good, Exellent – nominative expression of the effective attribute (the traditional state system of five-point assessment), and Nsat;15, Ngood;15, etc. – the frequency of joint occurrence of the corresponding values of two correlated indicators.

For example:

1 training module, test task

	Satisfactory	Good	Excellent
2015 academic year	14	18	8
2016 academic year	7	21	12
2017/2018 academic year	6	21	13

In other words, in 2015, 14 students received a grade of "3"/satisfactory, 18 students – "4"/good, 8 – "5"/excellent (average score was 3.9 points), etc.

Thus, we have compiled 21 pairing tables for each module and type of assignments (7 modules for three types of tasks), and it is not appropriate to cite them in the article. Next, the χ^2 – Pearson's chi-square test was calculated for each tables, which allows us to assess the statistical significance of differences in the success of educational programs in different years. The results of the calculation are presented in the summary Table 12.

Table 12. The results of the calculation

		χ^2-Pearson	p-level	Degrees of freedom
Module 1	Test	5,7	0,21	4
	Situational task	11,3	0,02	4
	Professional task	4,63	0,32	4

Module 2	Test	3,28	0,51	4
	Situational task	5,32	0,63	4
	Professional task	8,08	0,08	4
Module 3	Test	8,31	0,08	4
	Situational task	10,01	0,03	4
	Professional task	15,9	0,004	4
Module 4	Test	3,01	0,52	4
	Situational task	9,04	0,06	4
	Professional task	7,39	0,11	4
Module 5	Test	7,21	0,12	4
	Situational task	5,44	0,24	4
	Professional task	9,23	0,05	4
Module 6	Test	3,11*	0,21*	2*
	Situational task	2,80*	0,24*	2*
	Professional task	6,36	0,04	2*
Module 7	Test	4,92	0,29	4
	Situational task	5,30	0,23	4
	Professional task	14,6	0,006	4

* data for two years of research in 2015 and 2016, since module 6 was not passed in 2017/2018

4. Conclusion

Based on the results, it can be concluded that the greatest change in the level of material assimilation at a statistically significant level and at the level of trends occurred precisely when assessing knowledge by the method of situational and professional tasks.

Therefore, it can be argued that updating of the subject-profile training of bachelors of education in the field of life safety in the direction of strengthening the practice-oriented approach allows to improve the quality level of subject-profile training of future teachers.

5. Acknowledgements

The results of the research showed that updating the subject-profile training of bachelors of education in the field of life safety is a necessary measure to maintain the quality of education due to the specifics and rapid changes in the subject area of life safety knowledge. The transformation of the content of the subject-profile training of bachelors of education in the field of life safety indicates that at the present time it is necessary to transfer professional guidelines from the training of the classical teacher " Basics of life Safety" towards the training of a teacher-researcher who is able to carry out a wide range of not only pedagogical but also research tasks in the field of life safety education (this is due to the necessary inclusion of the modules "Additional education", "Training and research"). As evidenced by the approbation of the basic professional educational program, the presented content of the subject-profile preparation, allows to assume that the bachelor of education, studying in the direction (profile) "Education in the field of life safety" will be prepared to solve professional tasks of methodological, research, pedagogical profile, to the formation and development of active culture in students of a safe and healthy lifestyle.

References

Abramova, 2014 – *Abramova, S.V.* (2014). Teoreticheskaya podgotovka bakalavra obrazovaniya v oblasti bezopasnosti zhiznedeyatel'nosti: monografiya [Theoretical preparation of a bachelor of education in the field of life safety: monograph]. SPb.: Izd-vo RGPU im. A.I. Gertsena, 200 p. [in Russian]

Afanas'ev, 1980 – *Afanas'ev, V.G.* (1980). Sistemnost' i obshchestvo [System and society]. M.: Politizdat, 368. [in Russian]

Aver'yanov, 1985 – *Aver'yanov, A.N.* (1985). Sistemnoe poznanie mira [System knowledge of the world]. M.: Izd-vo polit. lit., 263 p. [in Russian]

Blauberg, 1975 – *Blauberg, I.V.* (1975). Tselostnost' i sistemnost' [Integrity and consistency] Sistemnye issledovaniya. Ezhegodnik. M.: Nauka, pp. 5-29. [in Russian]

Cherkasova, 2019 – *Cherkasova, O.V.* (2019). Antropologicheskii podkhod v vospitanii – osnova gumanisticheskoi pedagogiki [Anthropological approach in education-the basis of humanistic pedagogy] [Electronic resource]. URL: https://cyberleninka.ru/article/v/antropologicheskiy-podhod-v-vospitanii-osnova-gumanisticheskoy-pedagogiki (date of access: 10.03.2019). [in Russian]

Federal'nyi gosudarstvennyi obrazovatel'nyi standart – Federal'nyi gosudarstvennyi obrazovatel'nyi standart vysshego obrazovaniya po napravleniyu 44.03.01 Pedagogicheskoe obrazovanie [Federal state educational standard of higher education in the direction of 44.03.01 Pedagogical education] [Electronic resource]. URL: http://fgosvo.ru/uploadfiles/fgosvob/440301.pdf (date of access: 12.02.2019). [in Russian]

Gaisina, 2002 – *Gaisina, G.I.* (2002). Kul'turologicheskii podkhod v teorii i praktike pedagogicheskogo obrazovaniya [Cultural approach in the theory and practice of pedagogical education]. diss. d-ra ped. nauk. M. [in Russian]

Gundyreva, Gundyrev, 2007 – *Gundyreva, A.M., Gundyrev, V.B.* (2007). Mezhpredmetnye svyazi kak otrazhenie protsessov integratsii i differentsiatsii v nauke [Intersubject relations as a reflection of integration and differentiation processes in science]. *Nauka i shkola*. 4: 3-5. [in Russian]

Mikhailov, 2003 – *Mikhailov, L.A.* (2003). Kontseptsiya organizatsii podgotovki uchitelya bezopasnosti zhiznedeyatel'nosti v sovremennom pedagogicheskom universitete [The concept of organization of teacher training life safety in a modern pedagogical University]. dis. ... d-ra ped. nauk: 13.00.08. SPb., 340 p. [in Russian]

Novikov, 2005 – *Novikov, A.M.* (2005). Metodologiya uchebnoi deyatel'nosti [Methodology of educational activities]. M.: Izdatel'stvo «Etves», 176 p. [in Russian]

Sadovskii, 1978 – *Sadovskii, V.N.* (1978). Printsip sistemnosti, sistemnyi podkhod i obshchaya teoriya system [The principle of consistency, the system approach and the General theory of systems] Sistemnye issledovaniya. Ezhegodnik. M.: Nauka, pp. 7-25. [in Russian]

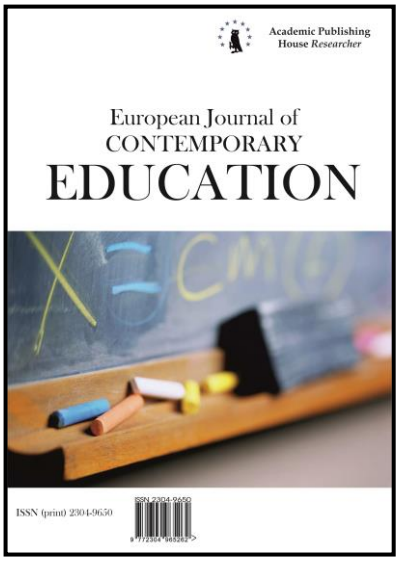
Solomin et al., 2011 – *Solomin, V.P., Stankevich, P.V.* (2011). Strategiya vysshego pedagogicheskogo obrazovaniya v oblasti bezopasnosti zhiznedeyatel'nosti [Strategy of higher pedagogical education in the field of life safety]. *Sovremennye problemy bezopasnosti: napravleniya, podkhody i tekhnologii. Sbornik materialov XV Vserossiiskoi nauchno-prakticheskoi konferentsii*. 4-6. [in Russian]

Stankevich et al., 2017 – *Stankevich, P.V., Abramova, S.V., Boyarov, E.N.* (2017). Formation of professional competency in contemporary bachelors of education: a noxological aspect. *Man in India*. 97(16): 117-130.

Yudin, 1978 – *Yudin, E.G.* (1978). Sistemnyi podkhod i printsip deyatel'nosti : metodologicheskie problemy sovremennoi nauki [System approach and principle of operation]. M.: Nauka, 391 p. [in Russian]

Zagvyazinskii, 2008 – *Zagvyazinskii, V.I.* (2008). Teoriya obucheniya: sovremennaya interpritatsiya [Learning theory: a modern interpretation]. Ucheb.posobie ddya stud. vyssh. ucheb. zavedenii 5-izd., ster. M.: Izdatel'skii tsentr «Akademiya», 192 p. [in Russian]

Published in the Slovak Republic
European Journal of Contemporary Education
E-ISSN 2305-6746
2020, 9(3): 645-656
DOI: 10.13187/ejced.2020.3.645
www.ejournal1.com



Research of Correlation of Theoretical Knowledge and Psychomotor Skills of Pupils in Technical Education

Ľubomír Žáčok [a, *], Milan Bernát [b], Renáta Bernátová [b], Ján Pavlovkin [a]

[a] Matej Bel University, Banská Bystrica, Slovak Republic
[b] University of Presov in Presov, Prešov, Slovak Republic

Abstract

The authors of the scientific study examine the impact of the relationship of theoretical knowledge on practical skills in technical subjects at the lower secondary level of education in the Slovak Republic. After determining the research problem and hypotheses, they bring the processed results in the form of tables and figures. Quantitative results within the pedagogical experiment are supplemented by qualitative analysis. In a scientific study, we characterize a research sample and research methods. We focus on a detailed description of problem tasks that pupils have solved in pedagogical research. Pedagogical research was carried out in four regions in the Slovak Republic.

At the end of the scientific study, the authors compare the results ascertained from previously published information in the field of science. We are based on modern approaches in pedagogy, which integrate the issue of assessing pupils psychomotor skills into the field of general education. The current objectives and tasks in subjects developing cognitive knowledge and psychomotor skills of pupils and specifically on the subject of technology, represent a body of knowledge and skill to be learned. In the information society, knowledge is growing in a geometric way, especially in the field of technical sciences. The knowledge that the pupil acquires at school will no longer be sufficient after solving the internship in solving the technical problems he will encounter. Scientific studies address this issue. We examine the influence of theory on the acquisition of practical skills. Both aspects are important in the development of the pupils' personality not only in the technical but also in the modern information society.

Keywords: teaching, pupil, skills, knowledge, research, technical education

1. Introduction

At present, technical education is one of the important and priority areas in our society. Effective solution of technical problem tasks requires a fundamental acquisition of theoretical

* Corresponding author
E-mail addresses: lubomir.zacok@umb.sk (Ľ. Žáčok)

knowledge and practical skills in lower, upper secondary education and at universities. Knowledge is memorized and learned facts, rules, and axioms. "Learned" means accepted by senses, understood and subjectively processed and fixed information, systems of ideas and concepts, rules, axioms, laws, definitions, theories. Educants acquire findings that become knowledge only when they acquire them. Skills are acquired readiness to perform correctly, as quickly as possible and with the least possible effort, a certain activity on the basis of acquired knowledge and previous practical activities. It can be a manual skill or an intellectual skill. In practice, we recognize motor and intellectual skills. The aim of the research is to find out how the 7th grade students are able to apply the acquired theoretical knowledge in solving practical problem tasks.

1.1. Definition of the research problem

We specify our research problem as a relational research problem: What is the impact of theoretical knowledge on solving technical problem tasks for students in lower secondary education. With this research problem formulated, we aim to determine the relationship between the phenomena being investigated (acquired theoretical knowledge in the subject of technology) and find out what their impact is on the effective solution of technical problem tasks. It is about explaining the relationship by cognitive processes and psychomotor skills in solving problem tasks at the level of learning specific and non-specific transfer according to Niemierk's taxonomy of educational goals. From the methodological point of view, we focus on the implementation of quantitative research, where we determine the relationship between the phenomena through research methods and tools. For quantitative research, we use observation sheets, where we record correct and incorrect answers of students. We also use mathematical – statistical methods to determine statistically significant differences among schools in individual regions in the Slovak Republic. We conceive research conclusions and findings into a new theory with regard to the needs of practice. Within the methodology of quantitative research, it is a branch of statistical analysis, where we focus our attention on monitoring the correct answers of students in solving practical problem tasks. We investigate how students can apply theoretical knowledge in solving practical problem tasks in the subject of technology.

2. Materials and methods

2.1. Selection and characteristics of the research sample

The research was carried out during the school year of 2019/2020 at 10 primary schools in the Slovak Republic. Two primary schools were from the Žilina Region, 3 primary schools were from the Banská Bystrica Region, 3 primary schools were from the Prešov Region, 2 primary schools were from the Nitra Region. The selection of the research sample was subject to deliberate selection. Based on the available possibilities and with regard to the efficiency and economy of the research, we selected the pupils of the 7th grade of primary schools. Chráska (2007) states that the extent of the selection of the number of respondents can be empirically estimated by determining its minimum and maximum value according to the relationships (Chráska, 2007):

$n_{min = 0.1}\sqrt{n}$ and $n_{max =}\sqrt{n}$

where n is the total number of elements in the basic group. In our case, according to the Statistical Yearbook, the basic groups of 15 September 2018 had a range of n = 41.046 pupils in the 7th grade of primary school. According to the above relationships, the interval of our selection group should be within a range of 20 to 203 students. The selection group in our research consisted of n = 120 pupils in the 7th grade of primary schools. From the Žilina and Nitra Regions 30 pupils (a total of 60 pupils) were included in the research sample, and from the Banská Bystrica and Prešov Regions 30 pupils (a total of 60 pupils) were included in the research sample.

2.2. Research procedure

The practical part of the research was carried out as follows:

1. We prepared 5 research problem tasks that contained unknown elements. Based on the acquired and known knowledge, the students had to practically solve the assigned problem tasks. The tasks were intended for pupils in the 7th grade of primary schools.

2. Before starting the research itself, we carried out a pilotage, during which we got acquainted with the conditions in selected classes of the 7th grade. After consulting with a technical teacher, we selected the research participants. We selected a total of 100 students of the same performance level.

3. We started to carry out the research with a research sample of 100 pupils who attend the 7th grade of primary schools. In total, we implemented 5 research units, which lasted a total of 15 teaching units.

4. As part of the research, we applied the prepared tools for stimulating the cognitive functions of the student and tools for developing various levels of understanding of theoretical knowledge.

5. Following the acquaintance with individual theoretical knowledge, students began to solve practical tasks in the subject of technology.

6. The course of the research was recorded in observation sheets. Subsequently, we made well-arranged tables from the data in the form of observation sheets, where we present the correct and incorrect answers of all students included in the research sample.

7. In the next part of the research, we compared the differences between students in individual regions using mathematical-statistical methods.

3. Results and discussion

The detailed analysis of individual students' answers by region is given in Table 1. Further, we present the complete wording of the task and a brief analysis of students' individual answers by region.

Table 1. Evaluation of solving practical tasks

Problém task	Solution options	7th grade students			
		ZA	PO	BB	NR
Problem task No. 1 Coat hanger	Technical sketch or technical drawing	R (20) W (10)	R (16) W (14)	R (15) W (15)	R (19) W (11)
	Measurement and contouring	R (21) W (9)	R (18) W (12)	R (17) W (13)	R (22) W (8)
	Drilling	R (20) W (10)	R (21) W (9)	R (22) W (8)	R (24) W (6)
	Cutting	R (23) W (7)	R (20) W (10)	R (21) W (9)	R (16) W (14)
	Sawing	R (27) W (3)	R (24) W (6)	R (16) W (14)	R (23) W (7)
	Bending	R (23) W (7)	R (21) W (9)	R (21) W (9)	R (22) W (8)
Problem task No. 2 Christmas decoration bell	Technical sketch or technical drawing	R (20) W (10)	R (19) W (11)	R (18) W (12)	R (21) W (9)
	Measurement and contouring	R (21) W (9)	R (20) W (10)	R (23) W (7)	R (22) W (8)
	Drilling	R (23) W (7)	R (22) W (8)	R (21) W (9)	R (21) W (9)
	Cutting	R (15) W (15)	R (16) W (14)	R (15) W (15)	R (21) W (9)
	Grinding	R (24) W (6)	R (18) W (12)	R (18) W (12)	R (14) W (16)

Problem task No. 3 Product - design	Technical sketch or technical drawing	R (24) W (6)	R (24) W (6)	R (23) W (7)	R (21) W (9)
	Measurement and contouring	R (21) W (9)	R (20) W (10)	R (23) W (7)	R (22) W (8)
	Other work operations (shearing, bending, etc.)	R (20) W (10)	R (21) W (9)	R (19) W (21)	R (21) W (9)
Problem task No. 4 Pen stand	Measurement and contouring	R (26) W (4)	R (25) W (5)	R (27) W (3)	R (28) W (2)
	Right choice of tools and implements	R (27) W (3)	R (24) W (6)	R (27) W (3)	R (19) W (11)
	Cutting	R (20) W (10)	R (22) W (8)	R (23) W (7)	R (21) W (9)
	Drilling	R (23) W (7)	R (24) W (6)	R (24) W (6)	R (24) W (6)
	Bending	R (28) W (2)	R (27) W (3)	R (28) W (2)	R (26) W (4)
Problem task No. 5 Set square	Technical sketch or technical drawing	R (22) W (8)	R (21) W (9)	R (22) W (8)	R (24) W (6)
	Material selection	R (28) W (2)	R (29) W (1)	R (30) W (0)	R (27) W (3)
	Right choice of technological procedure	R (21 W (9)	R (24) W (6)	R (26) W (4)	R (24) W (6)
Total number of responses		660	660	660	660
Number of correct answers		497	476	479	482
Number of incorrect answers		163	184	181	178

Legend: R – right solution, W – wrong solution

Analysis of students' answers

Problem task No. 1:

The students had the task to design a sketch or technical drawing of the hanger product. Then they had to make it correctly.

The technical sketch or technical drawing was correctly designed by 70 students out of a total of 12 students, which represents 58 %. The students mostly designed a technical sketch. We see the problem in the weaker or insufficient acquisition of knowledge from graphic communication. It was difficult for pupils to imagine the developed shape of the hanger, its representation and especially the correct dimensioning of the product. Pupils from the Žilina and Nitra Regions best solved this part of the task. The second part of solving the task was focused on making the designed product. Pupils had the biggest problems with transferring dimensions from a technical sketch or drawing to material. Most students (80-90 %) correctly chose and performed work operations.

It follows from it that although the students have gained knowledge from graphic communication, but in practice they are not able to apply it to solve practical tasks. Other necessary theoretical knowledge can be effectively applied by them in the manufacture of practical products, in this case a metal product – hanger.

Problem task No. 2:

The students had the task to design a wooden Christmas decoration, then to make it. The emphasis was on the right choice of work operation.

The technical sketch or technical drawing was correctly designed by 65 % of students. Students designed a technical sketch. Compared to the first task, the students achieved higher performance in the design of the technical sketch. We think that students have a better idea of Christmas decorations. They could imagine the shape of a Christmas decoration. They designed bells, stars, snowflakes, etc. Regarding the choice of the right work operation, we can say that 72 % of students were also able to transfer the dimensions from the sketch to the required material. Only 27 % of students had a problem making a hole in the material. The students were helped by the teachers to drill, which is also why the pupils managed this work operation at the required level. More than half of the students (56 %) managed to work with a hand saw (dovetail or cap). Quite a lot of students were not able to work with a hand saw or had problems with cutting. We consider insufficient acquisition of theoretical knowledge and insufficient practice of working with hand saws as one of the reasons for this unfavorable situation. During the last work operation, the students adjusted the product to its final form. Almost 62 % of students correctly held sandpaper in their hands and then performed the required operation in the right way. Here it is also necessary to devote more space to the use of the correct terminology (*emery*, correct sandpaper). When making this product, the students applied mainly work operations focused on the chip machining of technical materials (in our case wood). More attention needs to be paid to practicing work operations such as cutting, grinding, but also drilling.

Problem task No. 3*:*

The students had the task to design and make any product from steel sheet with a thickness of 0.5 mm and dimensions of 120 x 100 mm.

In solving this problem task, the students were very attentive and were able to design various sheet metal products. Pupils designed various animals (weasel, frog, tree, various logos, etc.). Almost 77 % of students managed the first part of the task at the required level and without mistakes. When measuring and transferring dimensions from a sketch or drawing, almost 28 % of students were not able to correctly transfer dimensions from a technical sketch or drawing to material. Here it is necessary to devote more time with students to repeating and consolidating the curriculum from graphic communication. Regarding the correct use of other work operations (shearing, bending, drilling), we can state that students managed them correctly in 68 %. Here we also see space for more frequent repeating and practicing of work operations (especially shearing). Finally, we evaluate students positively in solving this problem task, a larger number of students understand the acquired knowledge and are able to apply theoretical knowledge in the manufacture of any product.

Problem task No. 4*:*

According to the acquired theoretical knowledge, students should be able to transfer the dimensions from the designed technical drawing, choose the right tools and select the right technological procedures needed to make the product.

The task was focused on a specific transfer according to Niemierk's taxonomy of educational goals. In this case, the students received an already designed technical drawing. Their task was to correctly transfer the dimensions from the technical drawing to the material. Then they continued to choose the right work operation and the necessary work tools and implements. We evaluated three parts of the making of the designed product. 88 % of students managed the measurement and contouring. In this case, the students no longer designed the shape and dimensions of the product. They only had to transfer the finished dimensions to the material being processed. Pupils did this part of the task best. The next part of the task was focused on the correct choice of work tools and implements. Only 19 % of students made mistakes in the correct selection and use of work tools and implements. We state that even this part of the practical task was solved correctly by more students. In the last phase of solving the task, students were evaluated on the basis of the correct implementation of work operations. Pupils cut, drilled and finally bent the product being made. In most cases, the students managed the first two operations at the required level. The teachers helped them to bend, as the plastic had to be heated above the flame. We also evaluate the managing of the last phase of the product manufacturing positively. Students still have minor

shortcomings in the acquired theory. Elimination of the mentioned shortcomings is possible with more frequent repetition, consolidation and deepening of the acquired curriculum.

Problem task No. 5:

The students had the task to design a technical sketch or technical drawing of a specific product and then make a simple product – a set square. Then they had to choose a suitable material and design a technological procedure of making the product.

In most cases (74 %), students correctly designed a specific assigned product – a set square. Most students chose wood or metal as the material, which was the right procedure. Only a few students wanted to make a plastic set square, which we do not consider to be the right procedure. We also evaluated the correct choice of technological procedure. Only 21 % of students suggested incorrect technological procedure of making the product. We confirm that students have the acquired knowledge at the required level, but they still have a problem applying this theoretical knowledge in solving, making a practical product. This shortcoming can be eliminated not only by more frequent repetition of the curriculum, but also by solving several practical tasks, where students try out the necessary work operations to make various designed or assigned products.

Subsequently, we tested the established hypotheses at the level of significance $\alpha = 0.05$ (95 %).

H_0: The results achieved by students from the Žilina, Prešov, Banská Bystrica and Nitra Regions in solving practical problem tasks will be the same.

H_1: Pupils of the Žilina Region will achieve higher performance in solving practical problem tasks in comparison with pupils of the Prešov Region.

H_2: Pupils of the Žilina Region will achieve higher performance in solving practical problem tasks in comparison with pupils of the Banská Bystrica.

H_3: Pupils of the Žilina Region will achieve higher performance in solving practical problem tasks in comparison with pupils of the Nitra Region.

H_4: Pupils of the Žilina Region will achieve higher performance in solving practical problem tasks in comparison with pupils of the Prešov Region.

H_5: Pupils of the Banská Bystrica Region will achieve higher performance in solving practical problem tasks in comparison with pupils of the Prešov Region.

H_5: Pupils of the Banská Bystrica Region will achieve higher performance in solving practical problem tasks in comparison with pupils of the Nitra Region.

H_5: Pupils of the Prešov Region will achieve higher performance in solving practical problem tasks in comparison with pupils of the Nitra Region.

We were interested in what performances students achieve when solving problem tasks in the subject of technology. By solving practical tasks correctly, the student could get a maximum of 22 points of gross score (gs) while solving 22 partial practical tasks. From the descriptive statistics (Table 2) it is clear that students mastered the curriculum at an above-average level. The calculated arithmetic mean and standard deviation for pupils from the Žilina, Prešov, Banská Bystrica and Nitra Regions were calculated on the confidence interval: lower interval: -95 %, upper interval: +95 %. From the mean obtained from the measured research sample we derive the information that the calculated arithmetic mean for pupils from the Žilina Region is from the measurement confidence interval from 15.74 to 17.40, for pupils from the Prešov Region from the measurement confidence interval from 14.99 to 16.74, for pupils of the Banská Bystrica Region from the measurement confidence interval from 15.19 to 16.75 and for pupils of the Nitra Region from the measurement confidence interval of 15.38 to 16.75. We can say that the students solved the practical problem tasks at about the same level. Pupils from the Žilina Region achieved the best mean. The variation range for pupils in the Žilina Region is determined by a minimum value of 10 and a maximum value of 19, for pupils in the Prešov Region it is determined by a minimum value of 10 and a maximum value of 18, for pupils in the Banská Bystrica Region it is determined by a minimum value of 11 and a maximum value of 19, and for pupils in the Nitra Region the variation range is determined by a minimum value of 12 and a maximum value of 19.

The median for pupils of the Žilina Region was calculated to be 18, for pupils of the Prešov Region 16, for pupils of the Banská Bystrica Region 16 and for pupils of the Nitra Region 16. Thus, half of the pupils of the Žilina Region achieved performance in solving practical problem tasks (PPT) ≤ 18 points and the other half of the pupils achieved performance in solving practical

problem tasks (PPT) ≥ 18 points, also one half of pupils from the Prešov, Banská Bystrica and Nitra Regions achieved performance in solving practical problem tasks (PPT) ≤ 16 points and the other half of pupils achieved performance in solving PPT ≥ 16 points. Also from the descriptive statistics we can say that the peak coefficient is not equal to zero and therefore we state that the distribution of values is more pointed (asymmetrical) than the normal distribution of values.

It can also be seen from Figure 1 that the results achieved by pupils from all four regions differ. Figure 1 shows that the mean value of the group for pupils of the Žilina Region is equal to 28, for pupils of the Prešov Region it is equal to 16 and for pupils of the Banská Bystrica and Nitra Regions it is equal to 16. The median is the mean value that divides the respective series of values into two approximately equal halves. In the case of a symmetrical distribution of values, the median is the same as the mean. In our case, we found out that the calculated arithmetic mean and median are not the same. We measured the deviations of the median from the mean very small, for all students from all regions. The interquartile range represents the area of the mean 50 % of the values of the variables, i. e. for pupils of the Žilina Region from 13 to 19, for pupils of the Prešov Region from 10 to 18, for pupils of the Banská Bystrica Region from 12 to 19, and finally for pupils of the Nitra Region from 13 to 18. The interquartile range is the difference between the third and first quartiles (the 75th and 25th percentiles). The interquartile range is important in determining the so-called outliers. In our case, we found out that in addition to the group of students from the Žilina and Prešov Regions, there were few outliers outside the interval (interquartile range) in other research groups.

Table 2. Descriptive (basic) statistics

Variables	ZA	PO	BB	NR
Valid data	30	30	30	30
Missing data	0	0	0	0
Sum	497	476	479	482
Mean	16.57	15.87	15.97	16.07
Variance	4.94	5.50	4.38	3.37
Standard deviation	2.22	2.34	2.09	1.84
Variance coefficient	0.13	0.15	0.13	0.11
Standard error of mean	0.41	0.43	0.38	0.34
Upper 95 % CL of mean	17.40	16.74	16.75	16.75
Lower 95 % CL of mean	15.74	14.99	15.19	15.38
Geometric mean	16.40	15.68	15.83	15.96
Skewness	-1.05	-1.01	-0.30	-0.24
Kurtosis	3.49	3.42	2.47	2.06
Maximum	19	18	19	19
Upper quartile	18	18	18	18
Median	18	16	16	16
Lower quartile	15	15	15	15
Interquartile range	3	3	3	3
Minimum	10	10	11	12
Range	9	8	8	7
Centile 95	19	18	19	18
Centile 5	13	10	12	13

Table 3. Kruskal-Wallis test

Variables: ZA, PO, BB, NR
Groups = 4 df = 3 Total observations = 120
T = 2.077314 P = 0.5565
Adjusted for ties: T = 2.225042 P = 0.527

Table 4. Kruskal-Wallis test: all comparisons (Dwass – Steel – Chritchlow – Fligner)

Critical q (range) = 3.63316	
ZA vs PO (|-1.95048| > 3.63316)	not significant p = 0.5124
ZA vs BB (|-1.506391| > 3.63316)	not significant p = 0.7108
ZA vs NR (|-1.725646| > 3.63316)	not significant p = 6.140
PO vs BB (|0.085939| > 3.63316)	not significant p = 0.9999
PO vs NR (|0.108066| > 3.63316)	not significant p = 0.9998
BB vs NR (|0.107133| > 3.63316)	not significant p = 0.9998

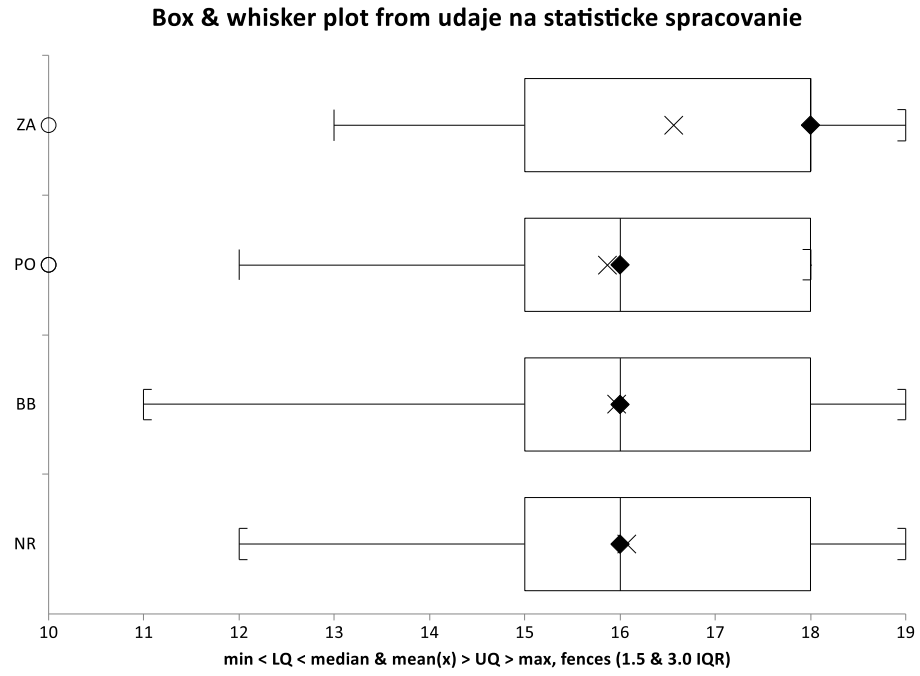


Fig. 1. Median, quartile and variational range of variables from solving practical tasks in the 7th grade students

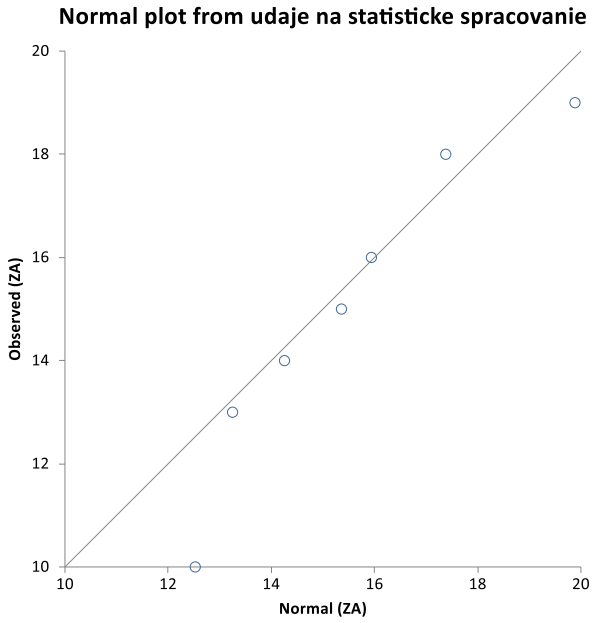


Fig. 2. Evaluation of the normality of random errors – graph of the normality of residues in the research group (ZA Region)

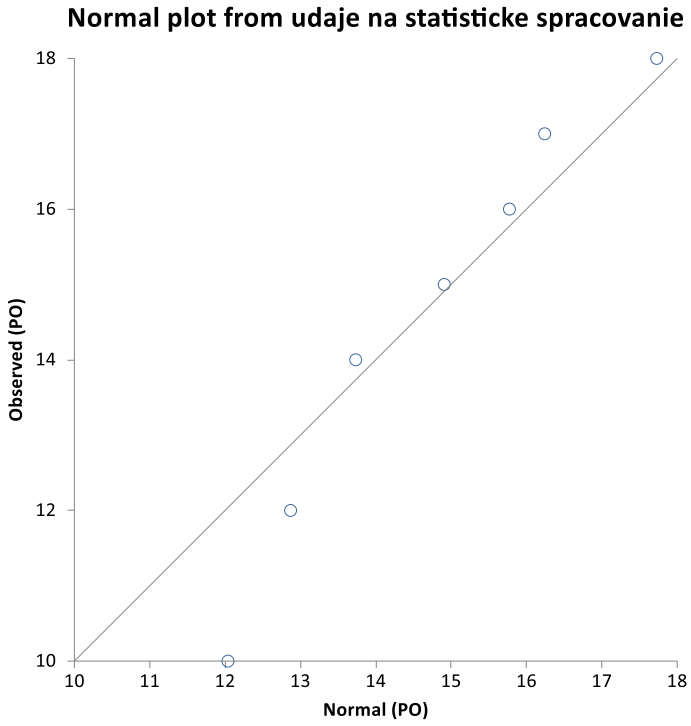


Fig. 3. Evaluation of the normality of random errors – graph of the normality of residues in the research group (PO Region)

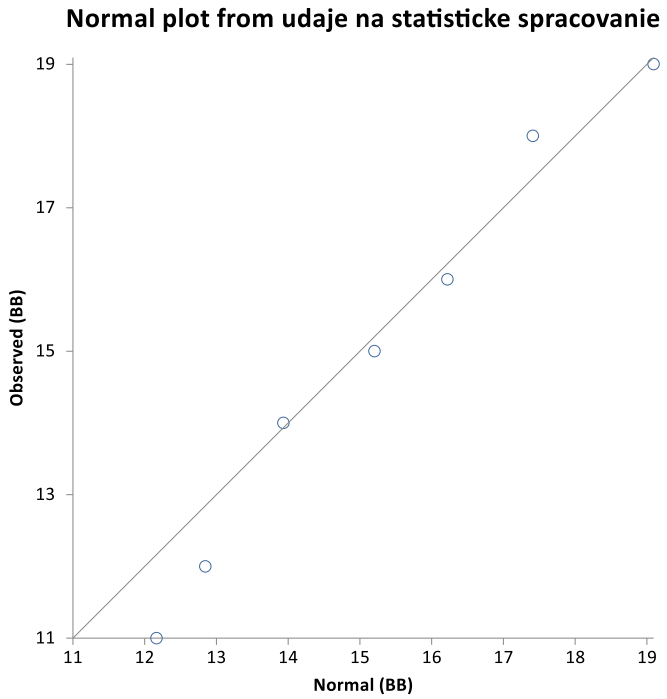


Fig. 4. Evaluation of the normality of random errors – graph of the normality of residues in the research group (BB Region)

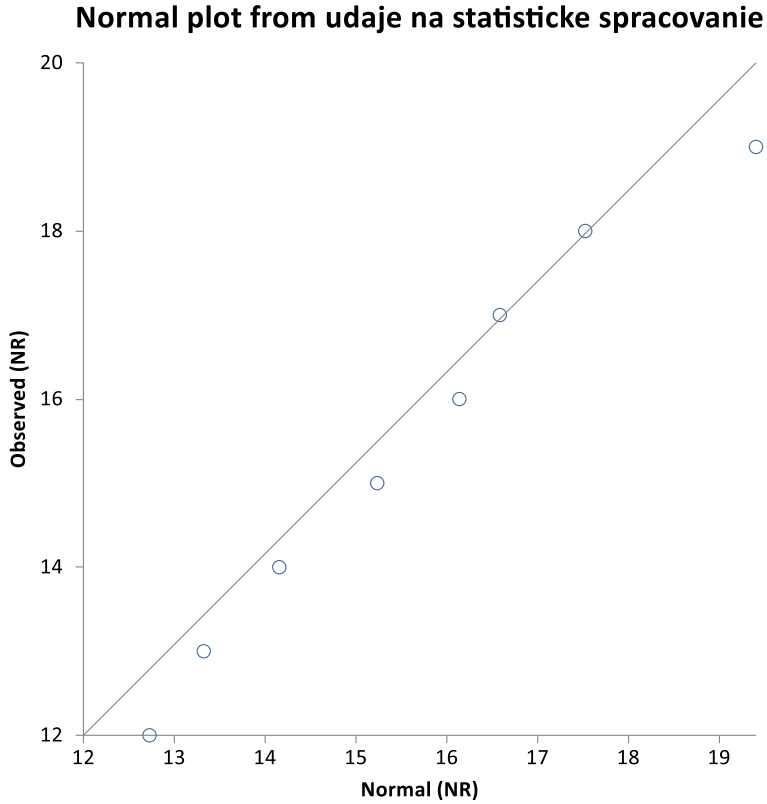


Fig. 5. Evaluation of the normality of random errors – graph of the normality of residues in the research group (NR Region)

Residue is the difference between the actual and estimated value. In our case, the residues have a normal distribution (Figures 2-5), because the graph of the normality of residues created a line or the appearance of normal probability graphs is acceptable. We also decided to use the non-parametric test based on the met requirement (variances between the research groups are not equal). Based on the findings, we decided to use the non-parametric Kruskal-Wallis test (Tables 3, 4). We reject the null hypothesis if $H \geq \chi^2_{1-\alpha(k-1)}$. For the level of significance $\alpha = 0.05$, the rejection area is determined by the value of the quantile $\chi^2_{1-\alpha(k-1)} = \chi^2_{0.95(1)} = 3.63316$. This means that the value of the testing statistic is not in the area of rejecting the null hypothesis. We found out that the calculated p value is a too large value, i.e. that the hypothesis H_o was confirmed at the level of significance $\alpha = 0.05$ (95 %). We also investigated whether there were also statistically significant differences between individual regions. This leads to the conclusion that the performances achieved by students from individual regions are not statistically different. The calculated p value is too large, and thus we not only confirm the null hypothesis and in conclusion we can state that the hypotheses H1 and H6 were not confirmed. As the results of our research prove, the differences between pupils from individual regions are different from descriptive statistics, but further research finds out that there are no statistically significant differences between the performances of pupils from individual regions.

Practical skills and solving technical problem tasks are of great importance in technical education. In order for a student to be able to have practical skills in solving various practical and problem tasks, he first needs to acquire quality theoretical knowledge. We can say that theory has the effect of acquiring the right practical skills and solving problem tasks. Through pedagogical research, we found out that the pupils of the 7th grade of primary school in individual self-governing regions acquired theoretical knowledge, but they show only minor shortcomings in solving technical problem tasks. We suggest that more emphasis be placed on assigning and solving technical problem tasks directly in the educational process in the subject of technology in lower secondary education. This attention needs to be paid already earlier in the technical education of children and pupils at pre-primary and primary level of education. The issues of acquiring skills in students in the psychomotor field have long been addressed by several experts. Professor Ján Bajtoš has published several scientific studies in this field. Not only did he develop taxonomy of educational goals in the psychomotor field, but he also elaborated and analyzed in detail the criteria for evaluating students' performance in the psychomotor field. This area of research in trade union didactics is important (Bajtoš, 2007). Developing and shaping psychomotor skills is part of general education. Abroad, Flitner (1990) and Hurrelmann (1998) addressed the issue. Psychomotor skills can be acquired in various forms of teaching (Flitner, 1990; Hurrellman, 1998). In the subject of technology they are: manual processing of technical materials, experimental activity (examination of basic properties of technical materials), etc. Teaching the subject of technology serves to develop the abilities and skills of students, which are necessary for various activities in their later lives, or for their future profession. Theoretical knowledge plays an important role, which can have a very significant effect on students' performance in the psychomotor field. Educators should have a positive effect on the performance of educants. To support educants in acquiring knowledge and skills through independent search, research and experimenting. It is important to focus more on the level of skill acquisition, use theoretical knowledge in practical activities, work skills. The teacher must make sure that the student is able to apply the acquired theoretical knowledge in practice, pay attention to the level of professional skills, so that his work skills are worthy of application in the labour market. Therefore, it is important that the teacher correctly evaluates and controls the student's readiness for teaching, quality and range of intellectual abilities and habits, motor skills, acquired knowledge and skills, activity, theoretical knowledge. The teacher should always focus on keeping students informed about what is expected of them during the lesson, otherwise their learning initiative will decrease. When evaluating psychomotor skills depending on the nature of the teaching process, it is also important to keep in mind a suitable choice of the level of taxonomy (Ascerud, 1998; Bloom et al., 1956; Bloor et al., 1992; Croplay, 2001 et al.).

4. Conclusion

Effective employment of an individual in the modern labour market requires quality preparation of the individual at the contemporary school. It is the ability of an individual to solve technical problem tasks that is his guarantee for a successful application in practice. Theory and practical skills form the basis for such mastering of established problem tasks. In accordance with the requirements of society and modern trends, for technically oriented subjects it is necessary to create ideal conditions for their development and consolidation of their firm place in the school system. Effective education of students in the technical field at the lower level of secondary education and subsequent continuation at the upper level of secondary education is a guarantee of a possible prospective employment of an individual in the labour market. Qualitative acquisition of theoretical knowledge by students is also a guarantee for the effective acquisition of skills in students in the psychomotor field. The implemented pedagogical research shows that students achieved the same performance in solving practical tasks, between which there were no statistically significant differences. Pupils achieved very good results in solving tasks in the psychomotor area. We can say that they have very good theoretical knowledge, which allows them to solve practical technical tasks at the required level. In the future, we will also focus on finding out practical skills of students from all grades of lower secondary education so that our research sample is as large as possible. Then we will be able to generalize the evaluated results to the entire population of students at the contemporary school. This scientific publication was supported by the Scientific Grant Agency of the Slovak Republic VEGA within the framework of grant No. 1/0147/19.

References

Ascerud, 1998 – *Ascerud, P.* (1998). A Guide to Sustainable Book Provision.Paris, UNESCO.

Bajtoš, 2007 – *Bajtoš, J.* (2007). Psychomotorická zložka osobnosti žiaka (formovanie, rozvoj a hodnoteniev technických predmetoch). Equilibria, s.r.o., 113 p.

Bloom et al., 1956 – *Bloom, B.S.* (Ed.). Engelhart, M.D., Furst, E.J., Hill, W.H.

Bloor et al., 1992 – *Bloor, et al.* (1992). A hypertext systemployment related language to hearing – impaired school leavers. *Computer & Education*. 18(1): 201-208.

Chajdiak, et al., 1994 – *Chajdiak, J., Rubliková, E., Gudaba, M*. (1994). Štatistické metódy v praxi. Bratislava: STATIS. 18(3): 152-155.

Chráska, 2007 – *Chráska, M*. (2007). Základy výzkumu v pedagogice. Olomouc: Palacký University.

Croplay, 2001 – *Croplay, A.J*. (2001). Creativity in Education and Learning. London, Kogan Page. 15(2): 123-126.

Dave, 1970 – *Dave, R.H*. (1970). Psychomotor levels in Developing and Writing Behavioral Objectives, pp. 20-21. R.J. Armstrong, ed. Tucson, Arizona: Educational Innovators Press.

Flitner, 1990 – *Flitner, A*. (1990). Schulreform und praktisches Lernen. Neue Sammlung, 30, Jahrgang. No. 3.

Harrow, 1972 – *Harrow, A*. (1972). A Taxonomy of Psychomotor Domain: A Guide for Developing Behavioral Objectives. New York: David McKay.

Hockicko et al., 2015 – *Hockicko, P., Krišťák, Ľ., Nemec, M*. (2015). Development of student´s conceptual thinking by means of video analysisandinteractive simulations at technical universities. *European Journal of Engineering Education*. 40(2): 145-166.

Hurrellman, 1998 – *Hurrellman, K*. (1998). Schulische Lernarbeit im Jugendalter. *Zeitrschrift fűr Pädagogik*. 34, No. 6.

Krathwohl, 1956 – *Krathwohl, D.R*. (1956). Taxonomy of Educational Objectives, Handbook I: The Cognitive Domain. New York: David McKay Co Inc.

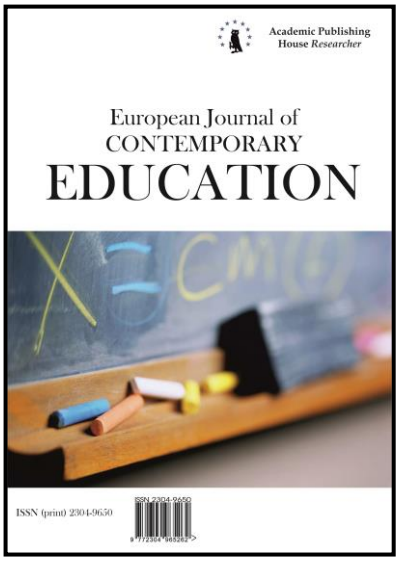
Meyer, et al., 2014 – *Meyer, J.P., Seman, M.A*. (2014). A comparison of the exact Kruskal-Wallis distribution to asymptotic approximations for all sample sizes up to 1. *Journal of Experimental Education*. 81(2): 139-156.

Simpson, 1972 – *Simpson, E.J*. (1972). The Classification of Educational Objectives in the Psychomotor Domain. Washington, DC: Gryphon House.

Turek, 1995 – *Turek, I*. (1995). Kapitoly z didaktiky. Bratislava: Metodické centrum Bratislava. 12(1): 158-161.

Žáčok, 2016 – *Žáčok, Ľ.* (2016). Technika a pracovný zošit pre 5. ročník základnej školy. Banská Bystrica. Belianum.

Published in the Slovak Republic
European Journal of Contemporary Education
E-ISSN 2305-6746
2020, 9(3): 657-665
DOI: 10.13187/ejced.2020.3.657
www.ejournal1.com



The History of Education

Educational Institutions under the Ecclesiastical Department in the Russian Empire (1860–1917): A Historical-Statistical Study

Aleksandr A. Cherkasov [a, b, c, *], Sergei N. Bratanovskii [d, e], Marina A. Ponomareva [f], Ludmila G. Zimovets [g]

[a] International Network Center for Fundamental and Applied Research, Washington, USA
[b] Volgograd State University, Volgograd, Russian Federation
[c] American Historical Association, Washington, USA
[d] Plekhanov Russian University of Economics, Moscow, Russian Federation
[e] Institute of State and Law of RAS, Moscow, Russian Federation
[f] Financial University under the Government of the Russian Federation, Moscow, Russian Federation
[g] Sochi State University, Sochi, Russian Federation

Abstract

This paper examines the process of the making and development of parochial schools in Russia in the pre-revolutionary period. An insight is provided into the scale of work carried out in that area, the evolution of parochial schools in Russia, and the regulatory framework for them. The main sources for this paper are reports from the Chief Procurator of the Holy Synod – more specifically, annual data from 'Extracts from the Report on the Department of the Orthodox Faith' and 'The Most Faithful Report of the Chief Procurator of the Holy Synod'. The authors employed the following methodological principles: those of historicism, systemicity, and objectivity. It is using a combination of these principles that it was possible to build a coherent picture of the development of said educational system in the Russian Empire in the period 1860–1917. The work employed the chronological principle and utilized a large body of statistical information. The use of the statistical method helped explore dynamics regarding the number of educational institutions under the Ecclesiastical Department and the size of their student body (including their student

* Corresponding author
E-mail addresses: a.cherkasov@incfar.net (A.A. Cherkasov)

gender balance) and establish the average number of students per educational institution under the Ecclesiastical Department.

The authors' conclusion is that in the period 1860–1917 the system of educational institutions under the Ecclesiastical Department went through two major periods of active development (one subsequent to the abolition of serfdom and the other subsequent to the adoption of The Rules for Parochial Schools) and one major period of stagnation (in the 1870s). Throughout said period, the educational system under the Ecclesiastical Department kept developing, with its schools getting bigger and grammar schools undergoing reorganization and the number of students per school within it growing continually. By 1914, the number of students enrolled in schools under the Ecclesiastical Department surpassed two million, which constituted nearly 25 % of all students in the Russian Empire. At the peak of its development, the school system under the Ecclesiastical Department was terminated in 1917, with the schools placed under the purview of the Ministry of Public Education.

Keywords: parochial schools, Holy Synod, Russian Empire.

1. Introduction

The Russian Empire has in its history many vibrant pages that over time have become faded, many due to misconstruction, turning virtually into "blank spots". A good example is the history of the development of parochial schools in Russia in the pre-revolutionary period. In both Soviet and contemporary, Russian, historiographies, the nation's parochial schools have had all kinds of labels pinned on them. The research reported in this paper offers an insight into the system of parochial education in Russia, with the primary focus on investigating the scale of work carried out in that area in the pre-revolutionary period.

2. Materials and methods

The main sources for this paper are reports from the Chief Procurator of the Holy Synod – more specifically, annual data from 'Extracts from the Report on the Department of the Orthodox Faith' and 'The Most Faithful Report of the Chief Procurator of the Holy Synod'. These annual reports contain virtually no information on parochial schools in the period 1836–1859. There are significant gaps in information for subsequent years too. For instance, there are information gaps in reports for the period 1888–1893. As regards the period 1860–1917, it is worth noting that prior to 1898 virtually no detailed data on educational institutions under the Ecclesiastical Department were published, with the only exception being the year 1887, while the number of teaching staff was covered only starting in 1900. Nevertheless, these reports are quite a valuable source on the history of educational institutions under the Ecclesiastical Department in the Russian Empire.

The authors employed the following methodological principles: those of historicism, systemicity, and objectivity. It is using a combination of these principles that it was possible to build a coherent picture of the development of said educational system in the Russian Empire in the period 1860–1917. The work employed the chronological principle and utilized a large body of statistical information. The use of the statistical method helped explore dynamics regarding the number of educational institutions under the Ecclesiastical Department and the size of their student body (including their student gender balance) and establish the average number of students per educational institution under the Ecclesiastical Department.

3. Results

The history of Russia's parochial school system appears to be as deep as the history of Russia itself, as the first parochial schools emerged in Russia back in the period of the Baptism of Russia. Schools of this kind were established at monasteries and churches and were intended for both sexes. As early as under Prince Yaroslav the Wise, Kiev became home to female schools where girls could not only study reading, writing, and arithmetic but acquire some special knowledge as well (e.g., the skills of sewing). The role of church education is attested by numerous documents. For instance, issues of primary education in the Russian Empire were addressed in the Book of One Hundred Chapters, a collection of decisions of the Russian Church Council of 1551 (Proekt polozheniya, 1883: 47).

Just like in Europe, up until the late 18th century church education remained in Russia the main type of primary education. However, on November 5, 1804, along with the University Statute

the government issued the Statute on Secondary and Primary Educational Institutions, which was to regulate the activity of schools in the Russian Empire, including parish schools (PSZRI, 1804–1805: 569-607).

Despite the adoption of the above statute, the Russian Empire hardly witnessed any considerable development of its parochial school system. This was associated with a number of reasons, including economic ones. Specifically, in 1825, according to a report from the Chief Procurator of the Holy Synod, the Russian Empire had in operation just 170 parish schools, with the figure being 188 schools 25 years later, in 1849 (Sbornik, 1896: 459).

Note that in the early 19th century parochial schools were established in Russia mainly through the efforts of the clergy of a parish on a voluntary basis. All issues related to the establishment and operation of parochial schools had to be handled by priests, whose teaching activity was not paid work. For this reason, the existence of such schools cost the government nothing. Normally, the period of study at such schools was one year (two years at most), with students only able to learn the basics of reading and writing at them. Due to lack of funding, most school buildings did not meet the minimum standards, with most schools housed in church lodges, the houses of priests, or those of peasants.

The situation began to change in 1858, when Emperor Alexander II learnt from a gubernatorial report that in a certain governorate there were in operation several schools established through the efforts of priests. From that moment, complete information was to be provided to the emperor on the activity of all such schools in the country (Yakovkina, 2002: 314).

In the period under review, the Ecclesiastical Department ran the following types of educational institution: church-teacher's, second-rate, model, two-grade, one-grade, and grammar schools. Below is an outline of each of these types of educational institution.

Church-teacher's schools were pedagogical male and female educational institutions established for the preparation of teachers for parochial schools. These educational institutions were created in accordance with The Regulations for Church Schools under the Department of the Orthodox Faith.

Second-rate teacher's schools were male and female educational institutions with a three-year period of study intended for the preparation of teachers for grammar schools.

Model schools, which were quite rare, were established as an exemplar for education. These schools implemented and streamlined new pedagogical methods and techniques and developed new academic literature.

Two-grade educational institutions were schools with a four-year period of study.

One-grade educational institutions were schools with a two-year period of study.

Grammar schools were always in wide use in villages, which was due to an underdeveloped system of public education in Russia at the time. The thing is that grammar schools did not require either a school building or school paraphernalia. Normally, grammar schools were set up by peasants themselves, who hired a special teacher, referred to as 'gramotey', for the purpose. Classes were held at the house of one of the village's peasants, for which reason these facilities were commonly known as home-based schools. In 1786, the operation of home-based grammar schools was restricted (they were outlawed). They were reinstated only in 1882 at the behest of Minister of Public Education Baron von Nicolay.

Table 1 displays the number of educational institutions under the Ecclesiastical Department, the number of students and teachers in them, and the average number of students per educational institution under the Ecclesiastical Department.

Table 1. Primary educational institutions under the Ecclesiastical Department in the period 1860–1914 (Izvlechenie iz otcheta, 1862: 89; Izvlechenie iz otcheta, 1864: 89; Proekt polozheniya, 1883: 50; Izvlechenie iz otcheta, 1867: 95; Izvlechenie iz otcheta, 1869: 95; Izvlechenie iz otcheta, 1871: 95; Izvlechenie iz otcheta, 1872: 93; Izvlechenie iz otcheta, 1873: 93; Izvlechenie iz otcheta, 1874: 91; Izvlechenie iz otcheta, 1876: 91; Izvlechenie iz otcheta, 1878: 91; Izvlechenie iz otcheta, 1881: 91; Izvlechenie iz otcheta, 1882: 91; Izvlechenie iz otcheta, 1883: 91; Izvlechenie iz otcheta, 1884: 93; Izvlechenie iz otcheta, 1885: 93; Vsepoddanneishii otchet, 1886: 93; Vsepoddanneishii otchet, 1887: 93; Vsepoddanneishii otchet, 1889: 95; Vsepoddanneishii otchet, 1889: 92-93; Vsepoddanneishii otchet, 1898: 139; Vsepoddanneishii otchet, 1901: 64, 67; Vsepoddanneishii otchet, 1902: 64, 67; Vsepoddanneishii otchet, 1903: 66-67, 76; Vsepoddanneishii otchet, 1905: 64,

72-73; Vsepoddanneishii otchet, 1905a: 66, 72-73; Vsepoddanneishii otchet, 1909: 120, 124, 128, 133, 136; Vsepoddanneishii otchet, 1910: 208-209, 252-253, 244-245; Vsepoddanneishii otchet, 1911: 216-217, 232-233, 246-247; Vsepoddanneishii otchet, 1913: 114-115; Vsepoddanneishii otchet, 1913a: 180-181, 208-209; Vsepoddanneishii otchet, 1915: 124-125; Vsepoddanneishii otchet, 1916: 126-127)

Year	Number of schools					Number of students			Number of students per school	Number of teachers
	Parochial		Grammar schools	Other schools*	Total	Boys	Girls	Total		
	Two-grade	One-grade								
1860	-	-	-	-	7,907	112,808	20,858	133,666	16.9	-
1861	-	-	-	-	18,587	271,263	49,987	320,350	17.2	-
1863	-	-	-	-	21,420	-	-	413,524	19.3	-
1866	-	-	-	-	19,436	328,349	54,831	383,181	19.7	-
1868	-	-	-	-	16,287	335,130	54,917	390,049	23.9	-
1870†	-	-	-	-	13,007	253,585	39,579	293,164	22.5	-
1871	-	-	-	-	10,381	220,127	33,286	253,413	24.4	-
1872‡	-	-	-	-	9,059	196,339	31,697	228,036	25.1	-
1873§	-	-	-	-	8,028	166,920	30,941	197,861	24.6	-
1875**	-	-	-	-	7,402	175,979	29,580	205,559	27.7	-
1877††	-	-	-	-	6,321	155,314	25,457	180,771	28.5	-
1879	-	-	-	-	4,681	101,569	16,611	118,230	25.4	-
1880	-	-	-	-	4,348	92,902	16,088	108,990	25.0	-
1881	-	-	-	-	4,404	87,747	17,034	104,781	23.7	-
1882‡‡	-	-	-	-	4,521	99,853	15,951	115,804	25.6	-
1883§§	-	-	-	-	5,942	100,346	18,253	118,599	19.9	-
1884	-	-	-	-	4,640	94,144	17,970	112,114	24.1	-
1885	-	-	-	-	8,351	167,564	27,671	202,350	24.2	-
1886	-	-	-	-	11,693	274,320	44,332	318,652	27.2	-
1887	-	7,876	7,595	-	15,471	-	-	408,721	26.4	-
1894	-	-	-	-	29,259	-	-	909,992	31.1	-
1895	-	-	-	-	31,835	-	-	981,076	30.8	-
1898	273	17,674	21,501	394	39,842	1,116,968	336,751	145,3719	36.4	-
1899	307	18,751	21,900	444	41,402	1,164,024	390,205	1,554,229	37.5	-
1900	358	20,054	21,711	481	42,604	1,205,552	428,909	1,634,461	38.3	48,078
1901	411	21,323	21,364	503	43,601	1,271,598	493,314	1,764,912	40.4	49,730
1902	510	23,165	20,294	-	43,969	1,273,696	509,187	1,782,883	40.5	49,820
1903	571	23,998	19,431	-	44,000	1,325,127	562,651	1,887,778	42.9	-
1904	602	24,687	18,118	-	43,407	1,326,002	576,576	1,902,578	43.8	50,055
1905	615	24,863	16,967	-	42,445	1,351,259	616,032	1,967,291	46.3	49,173
1906	640	24,990	15,603	-	41,233	1,372,223	626,306	1,998,529	48.4	48,433
1907	672	25,425	13,650	-	39,747	1,326,711	589,434	1,916,145	48.2	47,134
1908	702	27,792	10,655	-	39,149	1,308,987	589,269	1,898,256	48.4	46,745
1909	755	32,959	4,726	-	38,443	1,306,548	619,052	1,925,600	50.0	46,454
1910	811	33,412	4,003	-	38,226	1,300,183	648,884	1,949,067	50.9	46,392

* 'Other schools' means the following: church-teacher's, second-rate, and model schools.
† Incomplete data for the year. Data not available for 9 dioceses.
‡ Incomplete data for the year. Data not available for 4 dioceses.
§ Incomplete data for the year. Data not available for 5 dioceses.
** Incomplete data for the year. Data not available for 4 dioceses.
†† Incomplete data for the year. Data not available for 5 dioceses.
‡‡ Incomplete data for the year. Data not available for 4 dioceses.
§§ Incomplete data for the year. Data not available for 4 dioceses.

1911	845	33,760	3,166	-	37,771	1,297,334	679,549	1,976,883	52.3	46,777
1912	934	34,024	2,683	-	37,641	1,282,348	686,019	1,968,367	52.2	47,720
1913	980	34,241	2,369	-	37,590	1,291,921	718,270	2,010,191	53.4	48,399
1914	1,016	34,341	2,171	-	37,528	1,300,142	779,749	2,079,891	55.4	48,718

As evidenced in Table 1, in the period 1860–1914 educational institutions under the Ecclesiastical Department went through two major periods of active development. The first period was linked with the abolition of serfdom in Russia, with the highest number of parochial schools registered first in 1863 and later in 1903. Regarding the reasons behind the drop in the number of these schools, it is worth considering that from 1866 to 1882 due to lack of funding members of the clergy were for the most part unable to set up and maintain the operation of such schools at their own expense or with funding from their parish. As for the second period associated with the drop in the number of parochial schools (from 1904 to 1914), the process was linked with the enlargement of the school system, with grammar schools, which were few at the time, made part of parochial schools and one-grade schools reorganized into two-grade ones.

Another area that is of interest is the student gender ratio at the time. Specifically, in 1860 female students accounted for 15.6% of the total student body. In 1880, the figure was 14.7%, in 1886 – 13.9%, in 1908 – 31%, and in 1914 – 37.4%. Thus, the number of girls in the nation's parochial schools had grown more than two times.

An analysis of the size of the teaching workforce in educational institutions under the Ecclesiastical Department in the period 1900–1914 indicates that there was an average of 1.2 teachers per educational institution at the time. Across the majority of educational institutions under the Ecclesiastical Department, there was one teacher per school. However, in the nation's system of church schools there were two-grade schools, second-rate schools, and other types of school in which the number of teachers was a lot higher.

Another area that is of interest is the number of students per school under the Ecclesiastical Department. In 1860, there was an average of 16.9 students per school, while by 1914 the figure was now 55.4 students, an increase of over three times. The figure for 1860 is testimony that in 1860 the clergy tended to set up schools in places where it was impossible to establish ministerial schools and other types of school, namely lowly populated areas. This work conducted by members of the clergy is well comparable to missionary work, as they received no funding for their efforts.

Figure 3 illustrates the number of educational institutions under the Ecclesiastical Department in the period 1860–1914.

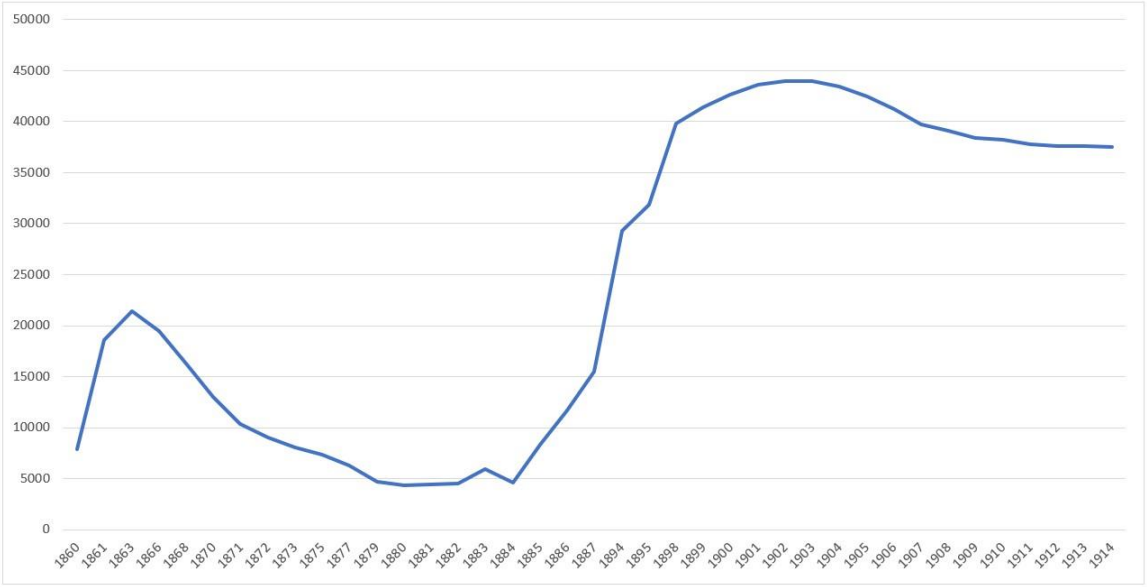


Fig. 1. Number of educational institutions under the Ecclesiastical Department in the period 1860–1914

Figure 2 illustrates the number of students in educational institutions under the Ecclesiastical Department in the period 1860–1914.

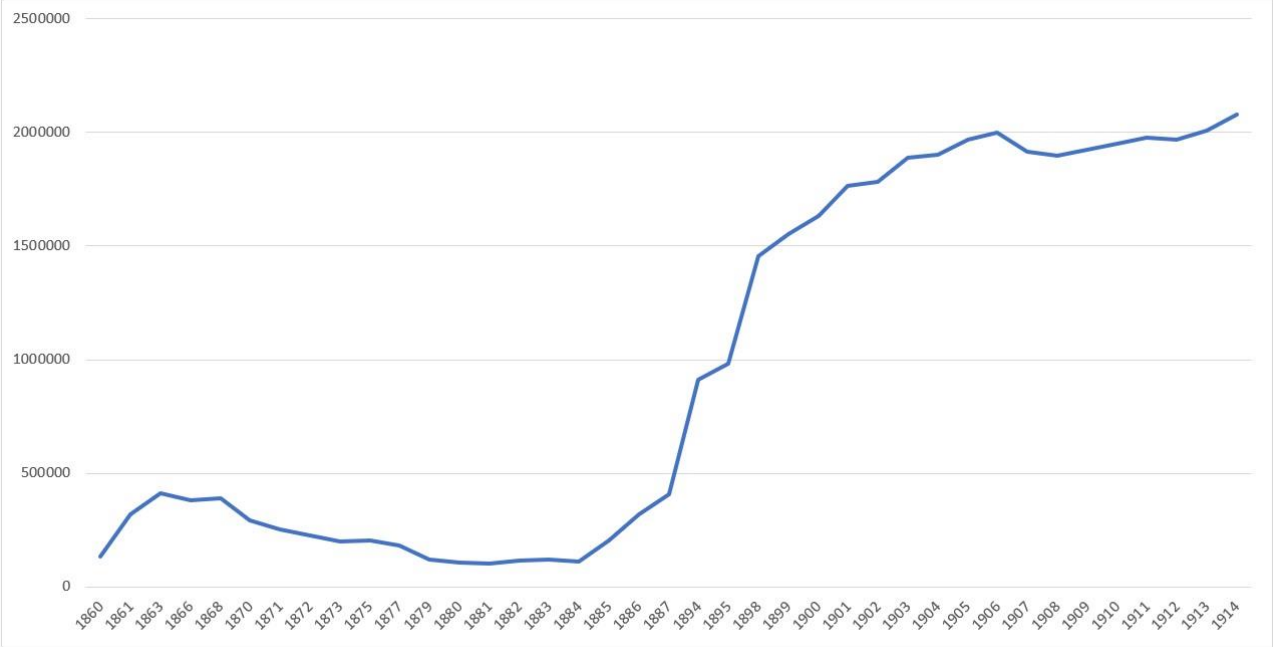


Fig. 2. Number of students enrolled in educational institutions under the Ecclesiastical Department in the period 1860–1914

Figure 3 illustrates the number of students per educational institution under the Ecclesiastical Department in the period 1860–1914.

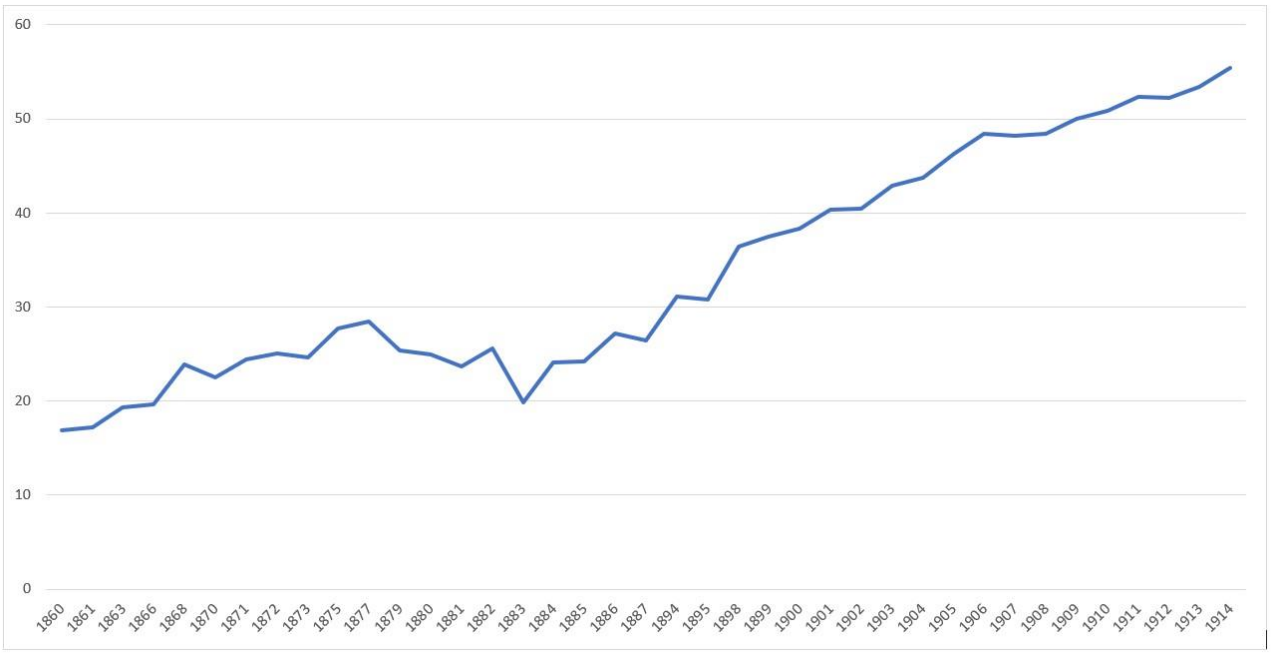


Fig. 3. Number of students per educational institution under the Ecclesiastical Department in the period 1860–1914

As the educational system under the Ecclesiastical Department developed further, extensive experience would be amassed in this area. In 1884, subsequent to the emperor signing into law

The Rules for Parochial Schools, parochial educational institutions were placed on one footing with ministerial schools in terms of the number of subjects taught, requirements for assignments, and pay. Progressive growth in the development of the educational system under the Ecclesiastical Department continued even into the opening stages of World War I. By that time, schools under the Ecclesiastical Department were attended by nearly 25% of all students in the Russian Empire. The first major blow to the educational system under the Ecclesiastical Department was dealt by the Provisional Government on June 20, 1917. Via its decree, the Provisional Government removed from the purview of the Holy Synod nearly 37,000 schools funded by the state (the Holy Synod had around 1,000 ecclesiastical schools left). Following the advent of the Bolsheviks to power and the adoption by them on December 24, 2017 of the Decree on the Transfer of the Purview of the Educational System under the Ecclesiastical Department to the People's Commissariat on Education, the rest of the schools were taken away from the Holy Synod as well. As a result, the Holy Synod had to relinquish completely its academic-pedagogical function in the country.

4. Conclusion

In the period 1860–1917, the system of educational institutions under the Ecclesiastical Department went through two major periods of active development (one subsequent to the abolition of serfdom and the other subsequent to the adoption of The Rules for Parochial Schools) and one major period of stagnation (in the 1870s). Throughout said period, the educational system under the Ecclesiastical Department kept developing, with its schools getting bigger and grammar schools undergoing reorganization and the number of its students per school growing continually. By 1914, the number of students enrolled in schools under the Ecclesiastical Department surpassed two million, which constituted nearly 25% of all students in the Russian Empire. At the peak of its development, the school system under the Ecclesiastical Department was terminated in 1917, with the schools placed under the purview of the Ministry of Public Education.

References

Izvlechenie iz otcheta, 1862 – Izvlechenie iz otcheta po vedomstvu dukhovnykh del pravoslavnogo ispovedaniya za 1860 god [Extract from the report on the department of spiritual affairs of the orthodox confession for 1860]. SPb., 1862. [in Russian]

Izvlechenie iz otcheta, 1864 – Izvlechenie iz otcheta po vedomstvu dukhovnykh del pravoslavnogo ispovedaniya za 1861 god [Extract from the report on the department of spiritual affairs of the orthodox confession for 1861]. SPb., 1864. [in Russian]

Izvlechenie iz otcheta, 1867 – Izvlechenie iz otcheta po vedomstvu dukhovnykh del pravoslavnogo ispovedaniya za 1866 god [Extract from the report on the department of spiritual affairs of the orthodox confession for 1866]. SPb., 1867. [in Russian]

Izvlechenie iz otcheta, 1869 – Izvlechenie iz otcheta po vedomstvu dukhovnykh del pravoslavnogo ispovedaniya za 1868 god [Extract from the report on the department of spiritual affairs of the orthodox confession for 1868]. SPb., 1869. [in Russian]

Izvlechenie iz otcheta, 1871 – Izvlechenie iz otcheta po vedomstvu dukhovnykh del pravoslavnogo ispovedaniya za 1870 god [Extract from the report on the department of spiritual affairs of the orthodox confession for 1870]. SPb., 1871. [in Russian]

Izvlechenie iz otcheta, 1872 – Izvlechenie iz otcheta po vedomstvu dukhovnykh del pravoslavnogo ispovedaniya za 1871 god [Extract from the report on the department of spiritual affairs of the orthodox confession for 1871]. SPb., 1872. [in Russian]

Izvlechenie iz otcheta, 1873 – Izvlechenie iz otcheta po vedomstvu dukhovnykh del pravoslavnogo ispovedaniya za 1872 god [Extract from the report on the department of spiritual affairs of the orthodox confession for 1872]. SPb., 1873. [in Russian]

Izvlechenie iz otcheta, 1874 – Izvlechenie iz otcheta po vedomstvu dukhovnykh del pravoslavnogo ispovedaniya za 1873 god [Extract from the report on the department of spiritual affairs of the orthodox confession for 1873]. SPb., 1874. [in Russian]

Izvlechenie iz otcheta, 1876 – Izvlechenie iz otcheta po vedomstvu dukhovnykh del pravoslavnogo ispovedaniya za 1875 god [Extract from the report on the department of spiritual affairs of the orthodox confession for 1875]. SPb., 1876. [in Russian]

Izvlechenie iz otcheta, 1878 – Izvlechenie iz otcheta po vedomstvu dukhovnykh del pravoslavnogo ispovedaniya za 1877 god [Extract from the report on the department of spiritual affairs of the orthodox confession for 1877]. SPb., 1878. [in Russian]

Izvlechenie iz otcheta, 1881 – Izvlechenie iz otcheta po vedomstvu dukhovnykh del pravoslavnogo ispovedaniya za 1879 god [Extract from the report on the department of spiritual affairs of the orthodox confession for 1879]. SPb., 1881. [in Russian]

Izvlechenie iz otcheta, 1882 – Izvlechenie iz otcheta po vedomstvu dukhovnykh del pravoslavnogo ispovedaniya za 1880 god [Extract from the report on the department of spiritual affairs of the orthodox confession for 1880]. SPb., 1882. [in Russian]

Izvlechenie iz otcheta, 1883 – Izvlechenie iz otcheta po vedomstvu dukhovnykh del pravoslavnogo ispovedaniya za 1881 god [Extract from the report on the department of spiritual affairs of the orthodox confession for 1881]. SPb., 1883. [in Russian]

Izvlechenie iz otcheta, 1884 – Izvlechenie iz otcheta po vedomstvu dukhovnykh del pravoslavnogo ispovedaniya za 1882 god [Extract from the report on the department of spiritual affairs of the orthodox confession for 1882]. SPb., 1884. [in Russian]

Izvlechenie iz otcheta, 1885 – Izvlechenie iz otcheta po vedomstvu dukhovnykh del pravoslavnogo ispovedaniya za 1883 god [Extract from the report on the department of spiritual affairs of the orthodox confession for 1883]. SPb., 1885. [in Russian]

Proekt polozheniya, 1883 – Proekt polozheniya o tserkovno-prikhodskikh shkolakh i ob"yasnitel'naya zapiska k nemu [Draft Regulations on parish schools and an explanatory note to it]. SPb., 1883. [in Russian]

PSZRI, 1804–1805 – Polnoe sobranie zakonov Rossiiskoi imperii, s 1649 goda [Complete collection of laws of the Russian Empire, from 1649]. T. 28 (1804-1805). №№ 21497–21500. Pp. 569-607. [in Russian]

Sbornik, 1896 – Sbornik russkogo istoricheskogo obshchestva [Collection of the Russian historical society]. T. 98. SPb., 1896. [in Russian]

Vsepoddanneishii otchet, 1886 – Vsepoddanneishii otchet ober-prokurora svyateishego sinoda po vedomstvu pravoslavnogo ispovedaniya za 1884 g. [The most submissive report of the chief prosecutor of the holy synod for the department of orthodo confession for 1884]. SPb., 1886. [in Russian]

Vsepoddanneishii otchet, 1887 – Vsepoddanneishii otchet ober-prokurora svyateishego sinoda po vedomstvu pravoslavnogo ispovedaniya za 1885 g. [The most submissive report of the chief prosecutor of the holy synod for the department of orthodo confession for 1885]. SPb., 1887. [in Russian]

Vsepoddanneishii otchet, 1888 – Vsepoddanneishii otchet ober-prokurora svyateishego sinoda po vedomstvu pravoslavnogo ispovedaniya za 1886 g. [The most submissive report of the chief prosecutor of the holy synod for the department of orthodo confession for 1886]. SPb., 1888. [in Russian]

Vsepoddanneishii otchet, 1889 – Vsepoddanneishii otchet ober-prokurora svyateishego sinoda po vedomstvu pravoslavnogo ispovedaniya za 1887 g. [The most submissive report of the chief prosecutor of the holy synod for the department of orthodo confession for 1887]. SPb., 1889. [in Russian]

Vsepoddanneishii otchet, 1895 – Vsepoddanneishii otchet ober-prokurora svyateishego sinoda po vedomstvu pravoslavnogo ispovedaniya za 1892 i 1893 gg. [The most submissive report of the chief prosecutor of the holy synod for the department of orthodo confession for 1892 and 1893]. SPb., 1895. [in Russian]

Vsepoddanneishii otchet, 1898 – Vsepoddanneishii otchet ober-prokurora svyateishego sinoda po vedomstvu pravoslavnogo ispovedaniya za 1894 i 1895 gg. [The most submissive report of the chief prosecutor of the holy synod for the department of orthodo confession for 1894 and 1895]. SPb., 1898. [in Russian]

Vsepoddanneishii otchet, 1901 – Vsepoddanneishii otchet ober-prokurora svyateishego sinoda po vedomstvu pravoslavnogo ispovedaniya za 1898 g. [The most submissive report of the chief prosecutor of the holy synod for the department of orthodo confession for 1898]. SPb., 1901. [in Russian]

Vsepoddanneishii otchet, 1902 – Vsepoddanneishii otchet ober-prokurora svyateishego sinoda po vedomstvu pravoslavnogo ispovedaniya za 1899 g. [The most submissive report of the

chief prosecutor of the holy synod for the department of orthodo confession for 1899]. SPb., 1902. [in Russian]

Vsepoddanneishii otchet, 1903 – Vsepoddanneishii otchet ober-prokurora svyateishego sinoda po vedomstvu pravoslavnogo ispovedaniya za 1900 g. [The most submissive report of the chief prosecutor of the holy synod for the department of orthodo confession for 1900]. SPb., 1903. [in Russian]

Vsepoddanneishii otchet, 1905 – Vsepoddanneishii otchet ober-prokurora svyateishego sinoda po vedomstvu pravoslavnogo ispovedaniya za 1901 g. [The most submissive report of the chief prosecutor of the holy synod for the department of orthodo confession for 1901]. SPb., 1905. [in Russian]

Vsepoddanneishii otchet, 1905a – Vsepoddanneishii otchet ober-prokurora svyateishego sinoda po vedomstvu pravoslavnogo ispovedaniya za 1902 g. [The most submissive report of the chief prosecutor of the holy synod for the department of orthodo confession for 1902]. SPb., 1905. [in Russian]

Vsepoddanneishii otchet, 1909 – Vsepoddanneishii otchet ober-prokurora svyateishego sinoda po vedomstvu pravoslavnogo ispovedaniya za 1903–1904 gg. [The most submissive report of the chief prosecutor of the holy synod for the department of orthodo confession for 1903–1904]. SPb., 1909. [in Russian]

Vsepoddanneishii otchet, 1910 – Vsepoddanneishii otchet ober-prokurora svyateishego sinoda po vedomstvu pravoslavnogo ispovedaniya za 1905–1907 gg. [The most submissive report of the chief prosecutor of the holy synod for the department of orthodo confession for 1905–1907]. SPb., 1910. [in Russian]

Vsepoddanneishii otchet, 1911 – Vsepoddanneishii otchet ober-prokurora svyateishego sinoda po vedomstvu pravoslavnogo ispovedaniya za 1908–1909 gg. [The most submissive report of the chief prosecutor of the holy synod for the department of orthodo confession for 1908–1909]. SPb., 1911. [in Russian]

Vsepoddanneishii otchet, 1913 – Vsepoddanneishii otchet ober-prokurora svyateishego sinoda po vedomstvu pravoslavnogo ispovedaniya za 1910 g. [The most substantial report of the chief prosecutor of the holy synod for the department of orthodox confession for 1910]. SPb., 1913. [in Russian]

Vsepoddanneishii otchet, 1913a – Vsepoddanneishii otchet ober-prokurora svyateishego sinoda po vedomstvu pravoslavnogo ispovedaniya za 1911–1912 gg. [The most authentic report of the chief prosecutor of the holy synod for the department of orthodox confession for 1911–1912]. SPb., 1913. [in Russian]

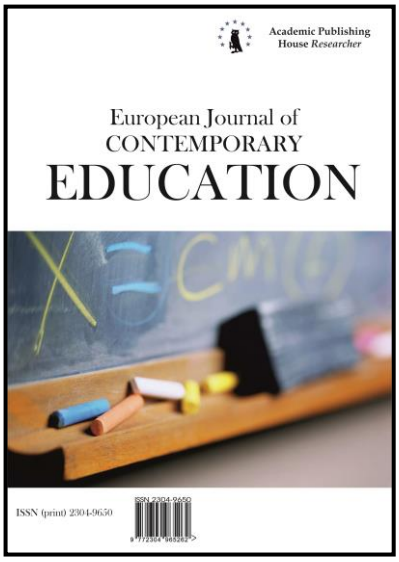
Vsepoddanneishii otchet, 1915 – Vsepoddanneishii otchet ober-prokurora svyateishego sinoda po vedomstvu pravoslavnogo ispovedaniya za 1913 g. [The most subordinate report of the Chief Prosecutor of the Holy Synod for the Department of Orthodox Confession for 1913]. SPb., 1915. [in Russian]

Vsepoddanneishii otchet, 1916 – Vsepoddanneishii otchet ober-prokurora svyateishego sinoda po vedomstvu pravoslavnogo ispovedaniya za 1914 g. [The most subordinate report of the chief prosecutor of the holy synod for the department of orthodox confession for 1914]. SPb., 1916. [in Russian]

Yakovkina, 2002 – *Yakovkina, N.I.* (2002). Istoriya russkoi kul'tury. XIX vek [The history of russian culture. XIX century]. SPb. [in Russian]

Zverev, 1895 – *Zverev, S.E.* (1895). K yubileyu Mikhailovskogo Voronezhskogo kadetskogo korpusa (8 noyabrya 1845 g. – 8 noyabrya 1895 g.) [To the anniversary of the Mikhailovsky Voronezh Cadet Corps (November 8, 1845 – November 8, 1895)]. Voronezh. [in Russian]

Published in the Slovak Republic
European Journal of Contemporary Education
E-ISSN 2305-6746
2020, 9(3): 666-678
DOI: 10.13187/ejced.2020.3.666
www.ejournal1.com



The Institution of Honorary Supervisors in the System of Public Education of the Russian Empire in the First Half of the 19th Century (The Case of the Kharkov Educational District): Duties, Career, Social Status, and Education Level. Part 2

Sergey I. Degtyarev [a, b, *], Lyubov G. Polyakova [b, c, d], Diana I. Stepanova [e]

[a] Sumy State University, Sumy, Ukraine
[b] International Network Center for Fundamental and Applied Research, Washington, USA
[c] Volgograd State University, Volgograd, Russian Federation
[d] East European History Society, Russian Federation
[e] Plekhanov Russian University of Economics, Moscow, Russian Federation

Abstract

In this work, the authors continue to explore the institution of honorary supervisors in the system of public education of the Russian Empire in the first half of the 19th century. Based on data from various related publications and archival materials, the authors have analyzed the dynamics of change in the number of honorary supervisors in schools within the Kharkov Educational District at the time. During the period under review, the number of this type of functionaries grew steadily, which attests to the high popularity of the post of honorary supervisor among the nobility. While it did not profit those who held it financially, the post could help raise their social status significantly.

It is difficult to establish the educational level of honorary supervisors, as service records did not always reflect this. At the same time, serving as an honorary supervisor involved active engagement in official correspondence with local authorities, the university senior management, etc. This suggests that the overwhelming majority of honorary supervisors in the Russian Empire did have an education.

The authors are convinced that further research into the institution of honorary supervisors and practices related to the institution of trusteeship within in the system of public education of the Russian Empire remains a relevant and promising line of research. It can offer valuable insights into the advisability of implementing some of the more effective elements of said practices in the present-day education system.

* Corresponding author
E-mail addresses: starsergo2014@gmail.com (S.I. Degtyarev)

Keywords: Russian Empire, Ministry of Public Education, honorary supervisor, uyezd school, Kharkov Educational District, functionary, nobility.

1. Introduction

This work continues the authors' research into the institution of honorary supervisors in the Russian Empire (Degtyarev, Polyakova, 2020). It continues to explore the characteristics of activity by this type of functionaries, their social status, and their significance for the nation's system of public education. Specifically, the authors have undertaken to analyze the dynamics of change in the number of honorary supervisors in schools within the Kharkov Educational District in the first third of the 19th century to determine the popularity of this post among nobles and functionaries. The work offers specific examples of how being an honorary supervisor could influence one's career and social status at the time.

The authors continue to explore past practices of trusteeship as a potentially promising area that can offer valuable insights into the advisability of implementing some of the more effective elements of said practices in the present-day education system (including the higher, secondary, and vocational education sectors). The use of said practices could well become one of the key components of government policy in this area, especially in the countries of Eastern Europe.

2. Materials and methods

In this part of the work, the authors will be relying less on scholarly works by their predecessors focused on the study of public education in the Russian Empire. That being said, it is without question that a large portion of those works have helped guide the choice of methodological approaches for this study. The pool of works related to honorary supervisors specifically has helped identify several little-researched aspects of the issue and guide the direction of this study.

In putting this work together, the authors drew upon relevant published materials, including certain regulations from 'Complete Laws of the Russian Empire' (PSZ-1; PSZ-2) and ads from 'Zhurnal Ministerstva Narodnogo Prosveshcheniya' (ZhMNP, 1849; ZhMNP, 1852). A greater use was made of 'Mesyatseslovs', a collection of directories for functionaries in the Russian Empire, from which information was obtained for the period 1815–1834 (Mesyaceslov, 1815-1834). This particular source helped the authors determine how the position of honorary supervisor was filled across uyezd schools within the Kharkov Educational District, trace the dynamics of change in the number of honorary supervisors, and, to a certain degree, examine how serving in the post of honorary supervisor influenced one's career and social status.

The authors also drew upon certain archival materials from the state archives of the Sumy and Kharkov oblasts (GASO; GAKhO).

As was the case with the work's previous part, this part's methodological basis is grounded in the principles of historicism and objectivism, which are aimed at providing a non-biased view of past events and phenomena through the prism of their development and dialectic interaction. A key approach employed by the authors is a historical-anthropological approach grounded in interdisciplinary methodology. This approach implies shifting from the study of a community of people (honorary supervisors) with common socio-professional functions to the study of specific individuals who sought to actualize their ambitions and raise their social status through public service.

In this part of the work, the authors made an extensive use of the methods of econometric history. This helped determine more accurately the dynamics of change in the numbers of uyezd and minor public schools within the Kharkov Educational District and honorary supervisors serving in them and analyze some other qualitative data dealing with the various aspects of the service of honorary supervisors.

3. Discussion

As already noted, honorary supervisors of uyezd schools have rarely been the subject of special research. Some attention has been devoted to their activity in several works exploring the 19th-century system of secondary education and the characteristics of the operation of uyezd schools in the Russian Empire (Degtyarev, Polyakova, 2020: 453). This pool of research includes the works of L. Artamonova (Artamonova, 2012; Artamonova, 2015), V. Mylko (Mylko, 2015),

E. Safina (Safina, 2016), and several other scholars. The role of honorary supervisors has also been examined in several works by the authors of the present work (Degtyarev, 2015b; Degtyarev, Magsumov, 2016; Degtyarev, 2018).

There is a small amount of research devoted to trustees and honorary supervisors specifically. As a rule, a key focus in this pool of research is on the characteristics of the service of this type of functionaries, their powers and rights, issues related to moral and status-based remuneration of their work, and issues related to statutory regulation of their activity (Degtyarev, 2015a; Galiullina, 2012a; Galiullina, 2012b; Galiullina, 2015; Gracheva, 2019; Smirnov, 2017).

A much larger amount of attention has been devoted by researchers to issues related to the development of the educational districts, as well as the mechanics of the creation and operation of networks of educational institutions in various governorates of the Russian Empire. Worthy of particular mention in this context is some research into the education systems in Vilna Governorate (Cherkasov et al., 2019; Cherkasov et al., 2019a; Cherkasov et al., 2019b; Cherkasov et al., 2019c), the Kuban and Don oblasts, which were administered by the Cossacks (Molchanova et al., 2019; Molchanova et al., 2019a; Molchanova et al., 2020; Peretyatko, Zulfugarzade, 2019; Peretyatko, Zulfugarzade, 2019a), and the Caucasus (Shevchenko et al., 2016; Magsumov et al., 2020; Magsumov et al., 2020a; Mamadaliev et al., 2020; Mamadaliev et al., 2020a).

4. Results

For some time, the Kharkov Educational District was the nation's largest educational district by area. It encompassed many governorates and oblasts in the Russian Empire. Yet, its boundaries kept changing. This was associated with two factors. Firstly, the empire kept undergoing administrative-territorial changes – now and then it would witness uyezds, governorates, and oblasts ceasing to exist as an administrative unit, with new administrative units emerging, certain existing uyezds merging into one, and some existing uyezds being placed under the jurisdiction of other governorates. Secondly, in the 19th century the Russian Empire witnessed the emergence of new universities. Some of these institutions of higher learning would become the centers of new educational districts, with entire regions that had once been part of the Kharkov Educational District falling under their jurisdiction.

Consequently, it is quite difficult to determine the exact number of uyezd schools within this district in different periods. One of the first scholars to attempt to establish this number was historian D. Bagalej (Table 1).

Table 1. Number of Minor Public and Uyezd Schools within the Kharkov Educational District (based on data from D. Bagalej)

Governorate, oblast	Year		
	1815	1818	1834
Sloboda Ukraine, Kharkov	11	10	11
Chernigov	9	12	-
Ekaterinoslav	5	5	-
Kursk	13	15	14
Oryol	8	9	11
Voronezh	6	7	7
Poltava	12	13	15
Kherson	6	5	-
Taurida	4	5	-
Kiev	-	1	-
Tambov	-	-	10
Caucasus Oblast	-	-	5
Don Cossack Host	4	4	8
Black Sea Cossack Host	1	1	-
Total	79	87	81

While D. Bagalej does provide the number of minor public and uyezd schools within the Kharkov Educational District in 1824, 1828, and 1830, he does not tell us their numbers across the governorates and oblasts. According to the scholar, in 1824 there were 86 such institutions, in 1828 – 97, and in 1830 – 104.

These data help gain an understanding of the size of the group of honorary supervisors in the Kharkov Educational District in a particular period whose services could be enlisted by the Russian Empire's education system and the size of the group of nobles who could satisfy their status-based ambitions through the post of honorary supervisor there at the time.

However, the information provided by the well-known historian requires clarifying. Using 'Mesyatseslovs', which contain lists of functionaries in the Russian Empire and the posts held by them, the authors made certain corrections to the data provided by D. Bagalej. It appears that, by mistake, the scholar sometimes included the number of educational institutions in governorates that were part of the Kharkov Educational District at the time he was writing his book but were not its part in the period that he was writing of. For example, D. Bagalej tells us that there were 10 schools in Tambov Governorate in 1834 that were part of the Kharkov Educational District (Bagalej, 1904: 1052). However, in 1834 Tambov Governorate did not belong to this district (it was its part in the early 20th century). In another case, D. Bagalej tells us that there were 11 of Oryol Governorate's schools within the Kharkov Educational District, whilst Oryol Governorate was no longer in existence at the time he was writing his book. The historian may have made some inaccuracies in reckoning the numbers of uyezd and minor public schools in various regions of the Kharkov Educational District in other periods too, which is attested by data for the corresponding years obtained by the authors from 'Mesyatseslovs'.

'Mesyatseslovs' also helped the authors determine the number of honorary supervisors who served in the period under review in schools within the Kharkov Educational District. Table 2 displays not only the number of honorary supervisors in them (Mesyaceslov, 1815-1834). It also illustrates the dynamics of change in the number of these functionaries over time, which makes it possible to draw some conclusions about the post's popularity among nobles. The dashes in the table indicate that in that specific period the region was not yet part of the Kharkov Educational District or was already out of its jurisdiction (accordingly, the number of honorary supervisors there is not provided).

Table 2. Numbers of Uyezd and Minor Public Schools within the Kharkov Educational District and Honorary Supervisors in Them

Governorate, oblast	1815		1818		1824	
	Schools	Honorary supervisors	Schools	Honorary supervisors	Schools	Honorary supervisors
Sloboda Ukraine	11	5	11	4	10	5
Chernigov	11	4	13	9	15	10
Ekaterinoslav	7	4	7	5	6	4
Poltava	14	10	14	11	15	13
Kursk	14	10	15	10	14	12
Oryol	10	3	10	4	11	10
Voronezh	7	4	7	6	7	5
Kherson	6	0	8	2	5	3
Taurida	4	0	5	2	5	2
Don Cossack Host	4	0	4	0	3	0

Black Sea Cossack Host	1	0	1	0	1	0
Kiev	-	-	-	-	1	0
Total	85	40	95	53	93	64

Governorate, oblast	1828		1830		1834	
	Schools	Honorary supervisors	Schools	Honorary supervisors	Schools	Honorary supervisors
Sloboda Ukraine	11	6	11	8	11	11
Chernigov	15	12	15	10	-	-
Ekaterinoslav	6	4	7	6	-	-
Poltava	15	14	15	14	15	13
Kursk	15	12	14	11	15	14
Oryol	-	-	-	-	-	-
Voronezh	-	-	-	-	8	6
Kherson	5	3	5	4	-	-
Taurida	6	2	6	1	-	-
Don Cossack Host	8	0	8	0	8	0
Black Sea Cossack Host	1	0	1	0	-	-
Kiev	5	0	4	0	-	-
Caucasus	4	3	4	3	5	4
Astrakhan	3	2	3	1	-	-
Bessarabia	-	-	6	0	-	-
Total	94	58	99	58	62	48

As evidenced from Table 2, in 1815 as many as 47 % of the schools had patron administrators in the person of honorary supervisors in them. In 1818, the figure was 55.8 %, in 1824 – 68.8 %, in 1828 – 61.7 %, in 1830 – 58.6 %, and in 1834 – 77.4 %. These are general statistics for the entire Kharkov Educational District. In actuality, it tells us very little about the popularity of the post of honorary supervisor. In interpreting the above quantitative data, you must take into account the characteristics of the development of governorates and oblasts whose educational institutions were under the jurisdiction of the Kharkov Educational District. Many were part of national regions just recently incorporated into the Russian Empire with a social structure different from the general, imperial, one. In these lands, the status of local elites was not yet established in full – i.e., they had yet to be converted to the Russian nobility format. Therefore, members of local elites were not always eligible for the post of honorary supervisor. In certain regions, there was no nobility as a social layer or the group was very small, which made it financially incapable of having its members take on the duties of a school benefactor. This was the case in the lands of the Don and Black Sea Cossacks and Bessarabia Oblast.

Therefore, to assess the popularity of the post of honorary supervisor among nobles as objectively as possible, it may help to use quantitative data on regions with a well-established social structure and administrative mechanism. In the period under review, these regions included the Sloboda Ukraine, Chernigov, Poltava, Ekaterinoslav, Kursk, Oryol, and Voronezh governorates (Table 3), i.e. a group of so-called Great Russian governorates and Ukrainian governorates that had long been part of the Russian Empire.

Table 3. Dynamics of Change in the Numbers of Uyezd and Minor Public Schools and Honorary Supervisors in Them in the Sloboda Ukraine, Chernigov, Poltava, Ekaterinoslav, Kursk, Oryol, and Voronezh Governorates

Governorate, oblast	1815		1818		1824	
	Schools	Honorary supervisors	Schools	Honorary supervisors	Schools	Honorary supervisors
Sloboda Ukraine	11	5	11	4	10	5
Chernigov	11	4	13	9	15	10
Ekaterinoslav	7	4	7	5	6	4
Poltava	14	10	14	11	15	13
Kursk	14	10	15	10	14	12
Oryol	10	3	10	4	11	10
Voronezh	7	4	7	6	7	5
Total	74	40	77	49	78	59

Governorate, oblast	1828		1830		1834	
	Schools	Honorary supervisors	Schools	Honorary supervisors	Schools	Honorary supervisors
Sloboda Ukraine	11	6	11	8	11	11
Chernigov	15	12	15	10	-	-
Ekaterinoslav	6	4	7	6	-	-
Poltava	15	14	15	14	15	13
Kursk	15	12	14	11	15	14
Oryol	-	-	-	-	-	-
Voronezh	-	-	-	-	8	6
Total	64	48	62	49	49	44

As evidenced from Table 3, in these governorates the post of honorary supervisor was quite popular among nobles, with its popularity growing continually. In 1815, there were honorary supervisors in 54 % of the schools, in 1818 – 63.6 %, in 1824 – 75.6 %, in 1828 – 75 %, in 1830 – 79 %, and in 1834 – 89.8 %.

The popularity of the post of honorary supervisor in uyezd schools had grown continually ever since it was established in the Russian Empire in 1811 (PSZ-1. Vol.31. №24754: 830). Starting in 1834, decisions about appointing one an honorary supervisor had to be made by the senior management of the university that was the center of an educational district, and then this had to be ratified by the Minister of Public Education (Pavlovskij, 1906: 123). Prior to that, the post of honorary supervisor was elective (although the Minister would still have to ratify it after the election) (PSZ-2. Vol.3. №2502: 1103).

One of the first elections of honorary supervisors in the Kharkov Educational District was held in 1812. Not all data on the election have survived to the present day. Some of the data are available in the State Archive of Kharkov Oblast. Specifically, it is known that in early 1812 the authorities held elections to appoint honorary supervisors in uyezd schools in Chernigov Governorate. A total of 13 supervisors were elected (Glukhov Uyezd School – collegiate councilor Ya. Magerovsky, Novozybkovsk Uyezd School – titular councilor I. Miklashevsky, Krolevetsk Uyezd School – collegiate assessor I. Bardakov, Surazhsk Uyezd School – collegiate councilor A. Khanenko, Gorodnyansk Uyezd School – collegiate councilor A. Bakurinsky, Novgorodseversk Uyezd School – court councilor V. Lobisevich, Konotopsk Uyezd School – N. Fedorovich, Sosnitsk Uyezd School – collegiate councilor M. Dunin-Borkovsky, Starodubsk Uyezd School – Count A. Bezborodko, Ostersk Uyezd School – poruchik I. Tansky, Kozeletsk Uyezd School – poruchik S. Baranovsky, Nezhin Uyezd School – state councilor M. Pocheka, and Chernigov Uyezd School –

titular councilor P. Yanko). A little later, court councilor F. Zabela was appointed to the post of honorary supervisor in Borzna. In Chernigov, the Little Russian governor general and the Minister of Public Education made an agreement not to ratify the candidacy of P. Yanko, as it was decided that there was no need for such a functionary there, since the Chernigov Uyezd School was already supervised by the principal of the Chernigov Gymnasium (GAKhO. F. 667. Op. 283. D. 116: 1; GAKhO. F. 667. Op. 283. D. 104: 4).

A little smaller is the amount of data available on honorary supervisors of uyezd schools appointed that same year, 1812, in Poltava Governorate. It is known that in the Kremenchug and Lubny uyezds they appointed to the post of honorary supervisor titular councilor Lysenko (aged 48), in Mirgorod Uyezd – captain Koretsky (44), in Kobeliaky Uyezd – rittmeister Kun (41), in Lokhvitsa Uyezd – junior captain Kalenichenko (37), in Pereiaslav Uyezd – collegiate assessor and marshal of the nobility Lukashevich, in Piryatin Uyezd – collegiate councilor Vikulovich, in Khorol Uyezd – court councilor and marshal of the nobility Alekseev (33) [the last name is written in the document illegibly; the authors managed to establish the functionary's name by consulting a different source (Pavlovskij, 1906: XXXI)], in Gadyach Uyezd – major Stanislavsky (49), and in Zenkov Uyezd – fleet captain-lieutenant Levenets (43) (GAKhO. F.667. Op.283. D.116: 23-24).

The authors also managed to clarify information on two honorary supervisors in Ekaterinoslav Governorate, also elected in 1812. To the post in the Novomoskovsk Uyezd School, they appointed poruchik Klevtsov (aged 27), and to that in the Bakhmut Uyezd School – poruchik Ivashov (42) (GAKhO. F. 667. Op. 283. D. 116: 24).

It is not known precisely what the material status of each of the above supervisors was. However, it can be stated with a high degree of probability that all of these individuals were wealthy nobles. This is reflected by the fact that every honorary supervisor would have to contribute to the school 100 rubles and up on a yearly basis. Sometimes, the amount reached 300, 500, or more rubles. On top of that, an honorary supervisor could pledge funds or even donate a real estate property of their own to the school.

The authors managed to clarify information on the material status of some of the above-mentioned honorary supervisors in Poltava Governorate. Specifically, titular councilor Lysenko owned 435 male serfs, captain Koretsky – 1,255 male serfs, rittmeister Kun – 106 male serfs, junior captain Kalenichenko – 40 male serfs, court councilor and marshal of the nobility Alekseev – 444 male serfs, major Stanislavsky – 604 male serfs, and fleet captain-lieutenant Levenets – 333 male serfs. No information could be found on the material status of Pereiaslav Uyezd Marshal of the Nobility Lukashevich and collegiate councilor Vikulovich. It is also known that honorary supervisor of the Novomoskovsk Uyezd School Klevtsov owned 740 male serfs, and honorary supervisor of Bakhmut Uyezd School Ivashov owned 199 male serfs.

The pursuit of ranks and awards to improve one's standing was not the only reason nobles were trying to get the post of honorary supervisor. The government had sought to make sure that the post would be held by individuals who sincerely cared about the development of education. Luckily, quite many nobles did evince a disposition to take an active part in making the nation's schools a better experience for its youth. For the most part, these individuals were not only wealthy but well-educated too. This fact is best illustrated by honorary supervisors of uyezd schools in governorates severed from Rzeczpospolita and incorporated into the Russian Empire back in the late 18th century. Many wealthy members of the local nobility (szlachta) viewed public service as an honorable mission. They believed that the responsibility rested upon *them*, members of the privileged szlachta estate, *exclusively* to fulfill that mission.

Table 4 displays some data on seven honorary supervisors of uyezd schools in the Podolia and Volhynia governorates. These data were obtained from their service records. They were appointed to the post of supervisor between 1819 and 1829, when the two governorates were still part of the Vilna Educational District. However, subsequent to the Polish uprising of 1830-1831 the district ceased to exist, with the Volhynia and Podolia governorates placed in early 1831 under the jurisdiction of the Kharkov Educational District. Accordingly, service records for all functionaries registered with the Ministry of Public Education, including honorary supervisors, were turned over to Kharkov University – the district's center (GAKhO. F.667. Op.283. D. 315). Table 4 lists the educational institutions that were under the tutelage of this type of supervisors. It also provides some information on the functionaries' material status and cites their high government awards and posts to give you an idea of the high social status of these individuals.

Table 4. Data on the Material and Social Status of Certain Honorary Supervisors in the Volhynia and Podolia Governorates

Supervisor, school	Material status, total male serfs	Ranks, titles, posts	Awards
K. Przezdziecki, Letichev and Proskurov uyezd schools (since 1828)	4,808	Count; chamberlain at the Imperial Court; active state councilor; Proskurov Uyezd Marshal of the Nobility (1808–1811); Podolia Governorate Marshal of the Nobility (1820–1832)	Highest Grace; Order of St. Anna, Second Class, with diamonds; Order of St. Vladimir, Third Class; Order of St. Stanislaus, First Class
F. Chatsky, Vladimir Uyezd School (since 1827)	2,325	Chairman of the School Funds Committee for the Volhynia, Podolia, and Kiev governorates	
E. Rakovsky, Kamenets Uyezd School (since 1827)	1,050	Judge of the Civil Appeals Court of Ushitsa Uyezd; Kamenets Uyezd Marshal of the Nobility (since 1827); honorary manufactory correspondent in Podolia Governorate	Order of St. Vladimir, Fourth Class; Order of St. Anna, Third Class; Highest Grace
V. Vozhidar-Pogorodensky, Rovno (1820–1823), Lutsk, and Klevan (since 1823) uyezd schools	2,326	Lutsk Uyezd Marshal of the Nobility (1820–1825); Volhynia Governorate Marshal of the Nobility (1825)	Order of St. Anna, Second Class
V. Boreiko, Rovno Uyezd School (since 1819)	N/A	Zemstvo commissioner; assessor to the Treasury Committee; deputy of the Volhynia Principal Court, Rovno Uyezd Marshal of the Nobility (1800–1806); member of the School Funds Committee for the Volhynia, Podolia, and Kiev governorates; head of the Education Committee; retired since 1815	Order of St. Anna, Second Class
V. Gansky, Zhitomir Uyezd School (since 1819)	3,882	Deputy of the Kiev Governorate Gentry Assembly; member of the Chapter of the Order of Malta; Radomyshl Uyezd Marshal of the Nobility (1808–1811), Volhynia Governorate Marshal of the Nobility (since 1811)	Order of St. John of Jerusalem (Maltese Cross); Order of St. Anna, Second Class, with diamonds; Order of St. Vladimir, Fourth Class; Highest Grace

V. Porchinsky, Ostrog Uyezd School (since 1829)	312	Deputy of the gubernia Gentry Assembly; Rovno Uyezd Marshal of the Nobility (since 1826); candidate for the post of Volhynia Governorate Marshal of the Nobility	Highest Grace; Order of St. Anna, Second Class

As already noted, the majority of honorary supervisors were well-educated individuals. D. Bagalej analyzed the educational level of supervisors in schools under Kharkov University at 1818 (Bagalej, 1904: 1095-1096). Unfortunately, the historian mixed up some of the quantitative data on honorary and full-time supervisors, which makes it impossible to establish the share of educated honorary supervisors at the time. Nevertheless, these data may provide a general idea of the educational and cultural level of persons who held the post of supervisor back then (Table 5).

Table 5. Educational Level of Honorary and Full-Time Supervisors of Public, Uyezd, and Powiat Schools under Kharkov University at 1818 (based on data from D. Bagalej)

Type of educational institution or way of receiving an education	Number of supervisors
Ecclesiastical education; teacher's seminary	5
Noble boarding school; noble school	3
Gymnasium	2
Home education	3
Collegium	10
State-run school; additional courses	2
Military educational institution (cadet corps, the Page Corps)	5
Medical surgical academy	1
Public school	4
University	2
Data not available	50
Supervisors believed not to have received an education	28

Information on the educational level of honorary supervisors was sometimes provided in their service records. Unfortunately, many of these documentary sources have not survived to the present day, while a portion thereof may have yet to be discovered by researchers amongst sizable archival material. However, even extant service records can be incomplete, which will make it impossible to establish the educational level of particular functionaries. For instance, the service record for honorary supervisor of the Letichev and Proskurov uyezd schools (Podolia Governorate) Count K. Przezdziecki contains no information on his education. The document was created in 1831. By that time, the count's age was 48 (i.e., he was born circa 1782 or 1783). With that said, the first entry in the service record is dated 1808, when the functionary was about 25 years old (at that time, he was appointed to the post of the Uyezd Marshal of the Nobility). This suggests the following three possible scenarios:

1) Count K. Przezdziecki may have not attended school at all, which appears to be improbable, considering the educational level of members of the medium and large szlachta engaged in public service in the lands of Rightbank Ukraine between the late 18th and the first half of the 19th centuries. It is also worth taking into account the very nature of service in the post of honorary supervisor, which involved active engagement in official correspondence with local authorities, the university senior management, etc.;

2) Count K. Przezdziecki may have received a home education. Facts of this kind were provided in service records quite rarely;

3) Count K. Przezdziecki may have received an education at one or several educational institutions, which could, too, have been left out of the service record for various reasons. Perhaps, information of this kind was available in other, earlier, service records for K. Przezdziecki but was not transferred to the 1831 document.

The service records for the other six honorary supervisors in Volhynia and Podolia Governorates, mentioned in Table 4, do not provide any data on their education either. Just like in the case of K. Przezdziecki, the first entry captured the start of their career in public service. This group of functionaries began service at the age of 19 to 20 (V. Gansky and V. Boreiko) and before the age of 27 (F. Chatsky). Thus, each of these individuals may have received a home education or graduated from a particular educational institution by the time of entering public service (GAKhO. F. 667. Op. 283. D. 315).

The service record for honorary supervisor of the Sosnitsa Uyezd School in Chernigov Governorate M. Dunin-Borkovsky does mention the fact of his having received an education – "He entered service after having completed a program of study at his own expense" (GAKhO. F. 667. Op. 283. D. 116: 7-8). However, the document does not specify which educational institution he attended. Basically, the entry was to reflect the actual fact of the future supervisor entering public service (Dunin-Borkovsky entered service in the Little Russian Collegium, opting for the local Cossack rank of bunchuk comrade) (Degtyarev et al., 2020). A little more specific is the education-related information provided in the service record for honorary supervisor of the Surazhsk Uyezd School A. Khanenko. It says there that Mr. Khanenko "attended the Imperial Moscow University Boarding School". The document even lists the courses he took there (GAKhO. F. 667. Op. 283. D. 116: 13-14).

Thus, entries in honorary supervisor service records alone will not provide you with all reliable information on their educational level that you need. To obtain or clarify this information, it definitely will help to draw upon additional documentary sources. This appears to be a promising thematic area of focus in the context of the study of the institution of honorary supervisors in the Russian Empire.

5. Conclusion

As already noted in the work's first part, the post of honorary supervisor was quite popular among nobles in the area covered by the Kharkov Educational District. Some nobles used serving in this post to improve their social status or public standing (by working toward a rank or even an award), with most tending to take their duties quite formally. At the same time, there were individuals who wholeheartedly took part in organizing and improving the work of uyezd schools, with many not only pledging funds of their own to the cause but taking an active part in the life of those institutions as well.

The data provided in this work attest to steady growth in the number of honorary supervisors in the Kharkov Educational District during the first third of the 19th century. The post appears to have enjoyed ever-increasing popularity at the time across the entire Russian Empire.

It is difficult, for now, to draw accurate conclusions about the educational level of the period's honorary supervisors. However, the authors are of the view that the overwhelming majority of these functionaries were educated. That said, their educational level may have varied – from an education received through home-based instruction to one acquired at a university.

The institution of honorary supervisors of uyezd schools appears to have played a highly significant role during the period of the making of the system of secondary education in the Russian Empire in the first half of the 19th century. At that time, the number of uyezd schools started to grow sharply, with the government unable to ensure the proper organization of educational institutions of this kind in each uyezd. The introduction of the post of honorary supervisor helped resolve the issue to a certain degree. The authorities virtually delegated to them a major portion of their own powers regarding the organization of educational institutions and the educational process in regions. That said, the government sought to implement an entire raft of motivational measures to interest one in the post. These incentives included the possibility of working toward a rank or an award and the virtual absence of punishment for careless performance of one's duties. Although working as a supervisor was considered a public service job, the senior management could simply discontinue the use of a wrongdoer's services. It is using honorary supervisors that the government managed to resolve many of the issues associated with the outfitting of uyezd schools with everything necessary, providing of students with textbooks, monitoring of the quality of education, and making of important decisions related to staffing.

References

Artamonova, 2012 – *Artamonova, L.M.* (2012). Shkolnye reformy XVIII – pervoj poloviny XIX veka v processe rossijskoj modernizacii [School reforms of XVIIIth – first half of XIXth century in the process of modernization of Russia]. *Vestnik Samarskogo gosudarstvennogo universiteta*. №2/2(93). Pp. 57-64. [in Russian]

Artamonova, 2015 – *Artamonova, L.M.* (2015). Provincialnoe uchitelstvo i ego zanyatiya naukoj v 1850-1860-e gg. (po arhivam i opublikovannym materialam Samarskoj gubernii) [Provincial teachers and their science classes in the 1850–1860-ies (on archival and published materials îf the Samara province)]. *Vestnik Samarskogo gosudarstvennogo universiteta*. №7(129). Pp. 140-148. [in Russian]

Bagalej, 1904 – *Bagalej, D.I.* (1904). Opyt istorii Harkovskogo universiteta (po neizdannym materialam). Tom 2 (s 1815 po 1835 god) [Experience of the history of Kharkov University (based on unpublished materials). Vol.2 (from 1815 to 1835)]. Harkov. 1136 p. [in Russian]

Cherkasov et al., 2019 – *Cherkasov, A.A., Bratanovskii, S.N., Koroleva, L.A., Zimovets, L.G.* (2019). Development of school education in the Vologda governorate (1725-1917). Part 1. *European Journal of Contemporary Education*. 8(1): 208-214.

Cherkasov et al., 2019a – *Cherkasov, A.A., Bratanovskii, S.N., Koroleva, L.A., Zimovets, L.G.* (2019). Development of school education in the Vologda governorate (1725-1917). Part 2. *European Journal of Contemporary Education*. 8(2): 418-424.

Cherkasov et al., 2019b – *Cherkasov, A.A., Bratanovskii, S.N., Koroleva, L.A., Zimovets, L.G.* (2019). Development of school education in the Vologda governorate (1725-1917). Part 3. *European Journal of Contemporary Education*. 8(3): 624-637.

Cherkasov et al., 2019c – *Cherkasov, A.A., Bratanovskii, S.N., Zimovets, L.G.* (2019). Development of school education in the Vologda governorate (1725-1917). Part 4. *European Journal of Contemporary Education*. 8(4): 973-983.

Degtyarev et al., 2020 – *Degtyarev, S.I., Nazarov, M.S., Polyakova, L.G., Gut, J.* (2020). The Local Titulature in the System of Civil Rank Production of the Russian Empire on the Ukrainian Lands in the Last Quarter of the XVIII century. *Bylye Gody*. 55(1). Pp. 49-56.

Degtyarev, 2015a – *Degtyarev, S.I.* (2015). Honorary Wardens of the District Schools of Chernigov and Poltava Provinces at the Beginning of the XIX Century: Competence, Social Status. *Zhurnal ministerstva narodnogo prosveshcheniya*. Vol. 6(4). Pp. 152-158. [in Russian]

Degtyarev, 2015b – *Degtyarev, S.I.* (2015). Public and State Significance The Ranks of the Table of Ranks in the Russian Empire at the End of XVIII – the First Half of the XIX Centuries. *Bylye Gody*. 38(4). Pp. 865-875.

Degtyarev, 2018 – *Degtyarev, S.I.* (2018). Participation of Municipal Government in Providing Premises of Educational Institutions of the Russian Empire at the County Level at the beginning of the 19th Century: on the Example of the Sumy City Council. *Zhurnal ministerstva narodnogo prosveshcheniya*. Vol.5(2). Pp. 63-81. [in Russian]

Degtyarev, Magsumov, 2016 – *Degtyarev, S.I., Magsumov, T.A.* (2016). Officials of Ministry of Public Education of the Russian Empire at the Beginning of the XIX century: Materials for the Study. *Zhurnal ministerstva narodnogo prosveshcheniya*. Vol. 9(3). Pp. 81-92. [in Russian]

Degtyarev, Polyakova, 2020 – *Degtyarev, S.I., Polyakova, L.G.* (2020) The Institution of Honorary Supervisors in the System of Public Education of the Russian Empire in the First Half of the 19th Century (The Case of the Kharkov Educational District): Duties, Career, Social Status, and Education Level. Part 1. *European Journal of Contemporary Education*. 9(2). Pp. 451-458.

Disson, 2008 – *Disson, Yu.A.* (2008). Litsei i blagorodnyie pansionyi v sisteme narodnogo prosvescheniya Rossii v pervoy treti XIX veka [Lyceums and noble guesthouses in the system of public education in Russia in the first third of the 19th century]: diss. ... kand. istor. nauk: 07.00.02. M. 307 p. [in Russian]

GAKhO – Gosudarstvennyy arkhiv Khar'kovskoy oblasti [State Archives of Kharkiv region]. [in Russian]

Galiullina, 2012a – *Galiullina, S.D.* (2012). Normativno-pravovoe regulirovanie instituta popechitelstva v narodnyh uchilishah Rossijskoj imperii [Normative legal regulation of the patronage institution in public schools of the Russian empire]. *Teoriya i praktika obshestvennogo razvitiya. Istoricheskie nauki*. № 5. Pp. 191-193. [in Russian]

Galiullina, 2012b – *Galiullina, S.D.* (2012). Popechitelstvo kak forma gosudarstvennoj sluzhby v Rossijskoj imperii [Guardianship as form of civil service in Russian empire]. *Vestnik Tambovskogo universiteta. Seriya: Gumanitarnye nauki*. Vyp. 9(113). Pp. 327-332. [in Russian]

Galiullina, 2015 – *Galiullina, S.D.* (2015). Gosudarstvennaya politika po popechitelstvu v obrazovatelnoj sfere [National policy on guardianship in the educational scope]. *Modern Research of Social Problems*. №1(45). Pp. 394-407. [Electronic resource]. URL: https://cyberleninka.ru/article/n/gosudarstvennaya-politika-po-popechitelstvu-v-obrazovatelnoy-sfere/viewer [in Russian]

GASO – Gosudarstvennyy arkhiv Sumskoy oblasti [State Archives of Sumy region]. [in Russian]

Gracheva, 2019 – *Gracheva, Yu.E.* (2019). Vizitacii popechitelej uchebnyh okrugov v nachale XIX veka [Visitations of educational districts' trustees at the beginning of the XIX century]. *Manuskript*. T. 12. Vyp. 10. Pp. 46-52. [in Russian]

Magsumov et al., 2020 – *Magsumov, T.A., Korolev, A.A., Ponomareva, M.A., Zulfugarzade, T.E.* (2020). The System of Public Education in Kars Oblast in the Period 1878–1917. Part 1. *European Journal of Contemporary Education*. 9(1): 221-234.

Magsumov et al., 2020a – *Magsumov, T.A., Korolev, A.A., Ponomareva, M.A., Zulfugarzade, T.E.* (2020). The System of Public Education in Kars Oblast in the Period 1878–1917. Part 1. *European Journal of Contemporary Education*. 9(2): 459-472.

Mamadaliev et al., 2020 – *Mamadaliev, A.M., Karpukhin, D.V., Svechnikova, N.V., Médico, A.* (2020). The System of Public Education in Tiflis Governorate in the Period 1802–1917. Part 1. *European Journal of Contemporary Education*. 9(1): 235-247.

Mamadaliev et al., 2020a – *Mamadaliev, A.M., Karpukhin, D.V., Svechnikova, N.V., Médico, A.* (2020). The System of Public Education in Tiflis Governorate in the Period 1802–1917. Part 2. *Bylye Gody*. 56(2): 530-540.

Mesyaceslov, 1815-1834 – Mesyaceslov s rospisyu chinovnyh osob ili obshij shtat Rossijskoj imperii [Mesyaceslov a list of officials or the general staff of the Russian Empire]. SPb.: pri Imperatorskoj Akademii Nauk. [in Russian]

Molchanova et al., 2019 – *Molchanova, V.S., Balanyuk, L.L., Vidishcheva, E.V., Potapova, I.I.* (2020). The Development of Primary Education on the Cossack Territories in 1803–1917 years (on the Example of the Kuban Region). Part 1. *Bylye Gody*. 53(3): 1049-1058.

Molchanova et al., 2019a – *Molchanova, V.S., Balanyuk, L.L., Vidishcheva, E.V., Potapova, I.I.* (2020). The Development of Primary Education on the Cossack Territories in 1803–1917 years (on the Example of the Kuban Region). Part 2. *Bylye Gody*. 54(2): 1524-1536.

Molchanova et al., 2020 – *Molchanova, V.S., Balanyuk, L.L., Vidishcheva, E.V., Potapova, I.I.* (2020). The Development of Primary Education on the Cossack Territories in 1803–1917 years (on the Example of the Kuban Region). Part 3. *Bylye Gody*. 55(1): 88-104.

Mylko, 2015 – *Mylko, V.* (2015). Povitovi uchylyshcha Ukrainy: merezha, finansuvannia, systema upravlinnia (1804-1849 rr.) [Schools of uyezd of Ukraine: network, funding, management system (1804–1849 years)]. *Ukrainskyi istorychnyi zbirny*k. Vyp. 18. Pp. 148-163. [in Ukrainian]

Pavlovskij, 1906 – *Pavlovskij, I.Fr.* (1906). K istorii poltavskogo dvoryanstva 1802-1902 g. Ocherki po arhivnym dannym [On the history of the Poltava nobility 1802-1902. Essays on archival data]. Vyp.1. Poltava: Elektrich. tipo-litogr. Torgovogo Doma I.Frishberg i S.Zorohovich. 277+XLI p. [in Russian]

Peretyatko, Zulfugarzade, 2019 – *Peretyatko, A.Y., Zulfugarzade, T.E.* (2019). «66 % of Literacy among the Male Population of School Age Brings it Closer to Common Education» vs «in the Largest Villages, it was Difficult to Meet a Literate Person»: the Main Statistical indicators of Primary Education among Don Cossacks in the XIX c. Part 1. *European Journal of Contemporary Education*. 8(2): 454-465.

Peretyatko, Zulfugarzade, 2019a – *Peretyatko, A.Y., Zulfugarzade, T.E.* (2019). «66 % of Literacy among the Male Population of School Age Brings it Closer to Common Education» vs «in the Largest Villages, it was Difficult to Meet a Literate Person»: the Main Statistical indicators of Primary Education among Don Cossacks in the XIX c. Part 2. *European Journal of Contemporary Education*. 8(3): 664-676.

PSZ-1 – Polnoe sobranie zakonov Rossijskoj imperii, sobranie 1 [Complete collection of laws of the Russian Empire, collection 1]. [in Russian]

PSZ-2 – Polnoe sobranie zakonov Rossijskoj imperii, sobranie 2 [Complete collection of laws of the Russian Empire, collection 2]. [in Russian]

Safina, 2016 – *Safina, E.A.* (2016). Rol obshestvennosti v funkcionirovanii narodnogo obrazovaniya v Rossijskoj imperii [The role of non-government organizations in functioning public education in the Russian]. *Vestnik UGNTU. Nauka, obrazovanie, ekonomika. Seriya: ekonomika*. №1(15). Pp. 125-129. [in Russian]

Shevchenko et al., 2016 – *Shevchenko, N.A., Vidishcheva, E.V., Emelyanova, O.V.* (2016). The establishment of the system of public education in the Caucasus (1802-1917 years): The characteristic features. *Bylye Gody*. 40(2): 363-372.

Smirnov, 2017 – *Smirnov, Yu.N.* (2017). Bezvozmezdnaya sluzhba po uchebnoj chasti kak «socialnyj lift» v doreformennoj Rossii: vvedenie dolzhnosti pochetnyh smotritelej uezdnyh uchilish [Free teaching service as a "social elevator" in pre-reform Russia: the introduction of honorary wardens in district schools]. Izvestiya vysshih uchebnyh zavedenij. *Povolzhskij region. Gumanitarnye nauki*. №4(44). Pp. 23-32. [in Russian]

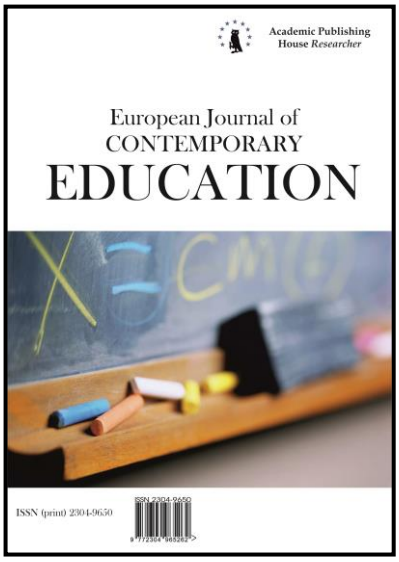
Sysoeva, 1998 – *Sysoeva, E.K.* (1998). K istorii nachalnogo obrazovaniya v Rossii v pervoy chetverti XIX v. (Uchilischnyiy ustav 1804 g.: idei i ih realizatsiya) [On the history of primary education in Russia in the first quarter of the 19th century (School charter 1804: ideas and their implementation)]. *Vestnik Moskovskogo universiteta*. Seriya 8. Istoriya. №5. Pp. 14-29. [in Russian]

Ustav, 1848 – Ustav gimnazij i uchilish uezdnyh i prihodskih, sostoyashih v vedomstve universitetov: Sanktpeterburgskogo, Moskovskogo, Kazanskogo i Harkovskogo [The charter of gymnasiums and schools of district and parish, consisting in the department of universities: St. Petersburg, Moscow, Kazan and Kharkov]. SPb.: Pri Imperatorskoj Akademii Nauk, 1848. 86 p. [in Russian]

ZhMNP, 1849 – Nagrazhdeniya, opredeleniya, naznacheniya i uvolneniya [Awarding, determination, appointment and dismissal]. *Zhurnal Ministerstva Narodnogo Prosvesheniya*. Ch.LXI. SPb.: V Tipografii Imperatorskoj Akademii Nauk, 1849. [in Russian]

ZhMNP, 1852 – Opredeleniya, peremesheniya i uvolneniya [Definitions, relocations and dismissals]. *Zhurnal Ministerstva Narodnogo Prosvesheniya*. Ch.LXXVI. SPb.: V Tipografii Imperatorskoj Akademii Nauk, 1852. [in Russian]

Published in the Slovak Republic
European Journal of Contemporary Education
E-ISSN 2305-6746
2020, 9(3): 679-688
DOI: 10.13187/ejced.2020.3.679
www.ejournal1.com



The Public Education System in Stavropol Governorate in the Period 1804–1917. Part 2

Olga V. Natolochnaya [a, b, f, *], Yurii N. Makarov [c], Ruslan M. Allalyev [d], Vladimir A. Svechnikov [e]

[a] International Network Center for Fundamental and Applied Research, Washington, USA
[b] Volgograd State University, Volgograd, Russian Federation
[c] Sochi State University, Sochi, Russian Federation
[d] Financial University under the Government of the Russian Federation, Moscow, Russian Federation
[e] Plekhanov Russian University of Economics, Russian Federation
[f] East European History Society, Russian Federation

Abstract

This paper examines the public education system in Stavropol Governorate in the period 1804–1917. The present part of the work covers the development of the region's public education system in the period 1872–1900, with a focus on the regional characteristics of the development of the governorate's network of educational institutions.

In putting this work together, the authors drew upon the following key sources: the annual publications 'Reports by the Trustee of the Caucasus Educational District on the Condition of the Educational Institutions' and 'The Most Faithful Reports of the Chief Procurator of the Holy Synod on the Department of the Orthodox Faith' and the statistical digests 'A Survey of Stavropol Governorate' and 'A Collection of Statistical Data on Stavropol Governorate'. In terms of methodology, the authors made extensive use of the statistical method. The use of this method helped identify some of the key distinctive characteristics of the making and development of the system of public education in Stavropol Governorate in the period 1872–1900.

The authors' conclusion is that in the period 1872–1900 the development of the public education system in Stavropol Governorate was characterized by a number of salient regional features. Specifically, there were many lowly populated areas in the region, which precluded the Ministry of Public Education from creating an extensive network of educational institutions. There was little to no growth in the number of secondary and lower ministerial educational institutions, while, despite some growth, the number of primary schools was insufficient too. In 1884,

* Corresponding author
E-mail addresses: incfar.natolochnaya@gmail.com (O.V. Natolochnaya)

subsequent to the adoption of The Rules for Parochial Schools, the governorate witnessed an upsurge in the establishment of parochial schools and grammar schools under the Ecclesiastical Department. This upsurge was so significant that by 1900 66 % of all students in the region were enrolled in schools run by the Ecclesiastical Department.

Keywords: Stavropol Governorate, public education system, period 1804–1871.

1. Introduction

It is a known fact that Stavropol Governorate did not exist as an administrative unit at the beginning of the period under review. In the early 19th century, the region formed part of Astrakhan Governorate (the areas where Stavropol Governorate, Terek Oblast, and Kuban Oblast were subsequently situated). In 1802, the governorate saw Caucasus Governorate being set apart into a separate constituent unit, with Georgiyevsk as its capital. However, that was not a very good place to site the governorate's capital, as it was a swampy area fraught with a high risk of disease for the locals. Twenty years later, Caucasus Governorate was renamed Caucasus Oblast, with Stavropol as its capital. In 1847, the region came to be known as Stavropol Governorate. This part of the work will examine the making of the system of public education in Stavropol Governorate in the period 1872–1900.

2. Materials and methods

In putting this work together, the authors drew upon the following key sources: the annual publications 'Reports by the Trustee of the Caucasus Educational District on the Condition of the Educational Institutions' and 'The Most Faithful Reports of the Chief Procurator of the Holy Synod on the Department of the Orthodox Faith' and the statistical digests 'A Survey of Stavropol Governorate' and 'A Collection of Statistical Data on Stavropol Governorate'. Information provided by these sources, especially in the initial period (1878–1890), is distinguished by being incomplete, which may be attributed to the fact that conclusive research on public education in both Stavropol Governorate in particular and the Russian Empire as a whole was only just getting started at the time.

In terms of methodology, the authors made extensive use of the statistical method. The use of this method helped identify some of the key distinctive characteristics of the making and development of the system of public education in Stavropol Governorate in the period 1872–1900. To achieve their research objectives, the authors also employed a set of general methods of research, including analysis and synthesis, concretization, and summarization. In addition, use was made of the historical-situational method to explore particular historical facts in the context of the era under study in conjunction with various "neighboring" events and facts.

3. Discussion

During the period under review, Stavropol Governorate's system of public education was part of the Caucasus Educational District. The systems of public education within the Caucasus Educational District have been researched at different times by different researchers. For instance, O.V. Natolochnaya has explored the activity of mountain schools in the Caucasus (Natolochnaya et al., 2018), T.A. Magsumov has investigated the system of public education in Kars Oblast (Magsumov et al., 2018), and V.S. Molchanova has researched the system of public education in Kuban Oblast (Molchanova et al., 2019; Molchanova et al., 2019a; Molchanova et al., 2020).

In 2016, a group of researchers led by N.A. Shevchenko brought forward and tested a new system for periodizing the development of the system of public education in the Caucasus. The system involves dividing the process into the following three major periods:

1) Period 1 (1802–1834), which covers the first initiatives by the Russian government in the area of public education; in this period, the right to provide instruction to the population was granted even to Protestants;

2) Period 2 (1835–1871), which witnessed a toughening of requirements for provision of instruction in the region's educational institutions and the centralization of the educational process;

3) Period 3 (1872–1917), in which educational institutions in the Caucasus became an analogue for educational institutions in the European part of Russia; by 1917, the process of the system's making was over (Shevchenko et al., 2016: 364).

In recent years, researchers have expressed keen interest in the study of the systems of public education in various governorates within the Russian Empire. Of particular interest in this respect are the works of A.Y. Peretyatko and T.E. Zulfugarzade devoted to the system of public education in the Cossack region of the Don (Peretyatko, Zulfugarzade, 2017; Peretyatko, Zulfugarzade, 2017a; Peretyatko, Zulfugarzade, 2019; Peretyatko, Zulfugarzade, 2019a). A team of researchers led by A.A. Cherkasov has explored the system of public education in Vologda Governorate (Cherkasov et al., 2019; Cherkasov et al., 2019a; Cherkasov et al., 2019b; Cherkasov et al., 2019c). Elsewhere, O.V. Natolochnaya has investigated the system of public education in Vilna Governorate (Natolochnaya et al., 2019; Natolochnaya et al., 2019a), and T.A. Magsumov has researched the system of public education in Vyatka Governorate (Magsumov et al., 2018).

4. Results

As noted in the previous part of this work, by 1871 Stavropol Governorate became home to an extensive network of educational institutions, which included two gymnasia, five lower uyezd schools, one St. Aleksandra female school, 52 primary educational institutions under the Ministry of Public Education, and 56 primary educational institutions under the Ecclesiastical Department (Natolochnaya et al., 2020: 478-479).

As noted already, statistical data on the public education system in Stavropol Governorate tend to be fragmentary. Prior to 1884, this information had undergone little to no aggregation. As a consequence, currently there is access to data on some educational institutions only. The situation with reporting began to change only in the 1880s. Below is an outline of the process of development of the public education system in Stavropol Governorate across the following three major levels: secondary, lower, and primary.

Secondary education

By 1884, the governorate had in operation the following educational institutions: the Stavropol Male Gymnasium (founded in 1837), the Pyatigorsk Male Progymnasium (1866), the Olga Female Gymnasium (1872), and the St. Aleksandra Female School (1849; formed by reorganization of a female lower school).

In 1881, the region became home to a real school (Otchet, 1885: applications). On September 1, 1895, it became home to the Pyatigorsk Female Progymnasium (Otchet, 1899: 166), which in 1900 would be reorganized into a female gymnasium (Otchet, 1901: 166).

Table 1 provides information on the region's secondary educational institutions under the Ministry of Public Education* and their student body.

As evidenced in Table 1, the region exhibited relatively weak dynamics with regard to the establishment of secondary educational institutions. In the 16-year period, it became home to just one more educational institution. This may have been associated with low demand for secondary education in the region, which is clearly attested by the poor enrollment in educational institutions within it in the period 1889–1892. However, it is worth noting that starting in 1895 the region witnessed significant enrollment in the Stavropol Male Gymnasium (over 500 students) and the Olga Female Gymnasium (495 students at 1900). This is testimony that the authorities would soon need to open additional secondary educational institutions. As regards the gender balance, throughout the period under review the region witnessed a slow rise in the number of female students versus that of male students.

* In addition, Stavropol Governorate had in operation one military school under the Military Department.

Table 1. Numbers of Secondary Educational Institutions under the Ministry of Public Education and Students in Them in Stavropol Governorate in the Period 1884–1900 (Otchet, 1885: applications; Otchet, 1886: applications; Otchet, 1887: 4, applications, 168; Otchet, 1890: № 1, 28, 51, 106, 127; Otchet, 1891: № 1, 25, 51, 77, 106, 127; Otchet, 1892: № 1, 25, 51, 77; 106, 127; Otchet, 1893: № 1, 25, 51, 77, 106, 127; Otchet, 1894: № 1, 25, 51, 77, 106, 127; Otchet, 1895: № 1, 25, 51, 77, 106, 127; Otchet, 1896: 2, 50, 105, 131, 162, 204; Otchet, 1897: 6, 54, 109, 135, 166, 208; Otchet, 1899: 6, 54, 109, 135, 208; Otchet, 1900: 6, 54, 109, 135, 166, 208; Otchet, 1901: 6, 54, 109, 135, 166, 208)

Year	Gymnasia		Progymnasia		Real schools	Total	Number of students		
	Male	Female	Male	Female			Boys	Girls	Total
1884	1	2	1	-	1	5	755	561	1,316
1885	1	2	1	-	1	5	793	556	1,349
1886	1	2	1	-	1	5	824	581	1,405
1889	1	2	1	-	1	5	670	521	1,191
1890	1	2	1	-	1	5	629	527	1,156
1891	1	2	1	-	1	5	655	531	1,186
1892	1	2	1	-	1	5	668	526	1,194
1893	1	2	1	-	1	5	705	514	1,219
1894	1	2	1	-	1	5	763	589	1,352
1895	1	2	1	-	1	5	810	626	1,436
1896	1	2	1	-	1	5	890	660	1,550
1898	1	2	1	1	1	6	951	794	1,745
1899	1	2	1	1	1	6	994	863	1,857
1900	1	3	1	-	1	6	1,045	939	1,984

Lower education

Prior to 1871, lower education in Stavropol Governorate was mainly represented by uyezd and private Stavropol female schools.

In 1872, Stavropol Governorate became home to a lower tradesman's specialized school, and in 1880 – to the Stavropol Urban School (Otchet, 1885: applications). In addition, in 1898 the authorities reorganized into the Lower Vorontsovo-Aleksandrovskaya Tradesman's School a school established back in 1808 (Otchet, 1899: 406).

A fact worthy of note is that the governorate also became home to several private lower educational institutions, mostly those for girls. However, as these facilities did not remain in operation for long, the authors did not include them in the table*. Table 2 provides data on lower educational institutions in Stavropol Governorate in the period 1884–1900.

* Information on all private educational institutions in operation in Stavropol Governorate in the period under review is provided in Table 4.

Table 2. Numbers of Lower Educational Institutions and Students in Them in Stavropol Governorate in the Period 1884–1900 (Otchet, 1885: applications; Otchet, 1886: applications; Otchet, 1887: 198, 218, 232, 254; Otchet, 1890: № 185, 203, 241, 256; Otchet, 1891: № 184, 199, 240, 258; Otchet, 1892: № 184, 199, 240, 258; Otchet, 1893: № 184, 199, 240, 258; Otchet, 1894: № 184, 199, 240, 258; Otchet, 1895: № 184, 199, 240, 258; Otchet, 1896: 290, 316, 392; Otchet, 1897: 294, 320, 426, 456; Otchet, 1899: 294, 322, 406, 436; Otchet, 1900: 294, 348, 456, 486; Otchet, 1901: 294, 348, 456, 486)

Year	Urban schools	Tradesman's specialized schools	Tradesman's schools	Total	Number of students		
					Boys	Girls	Total
1884	1	1	-	2	213	-	213
1885	1	1	-	2	208	-	208
1886	1	1	-	2	198	-	198
1889	1	1	-	2	266	-	266
1890	1	1	-	2	254	-	254
1891	1	1	-	2	278	-	278
1892	1	1	-	2	295	-	295
1893	1	1	-	2	318	-	318
1894	1	1	-	2	330	-	330
1895	1	1	-	2	328	-	328
1896	1	1	-	2	335	-	335
1898	1	1	1	3	385	-	385
1899	1	1	1	3	413	-	413
1900	1	1	1	3	413	-	413

As evidenced in Table 2, just like the number of secondary ones, the number of lower educational institutions in Stavropol Governorate did not grow by much in the period under review – there was just one additional educational institution. Given that lower education was specific, these schools were attended by boys only, with the number of students in them growing nearly two times in the period 1884–1900. Just like the region's secondary education system, its lower education system needed the opening of additional educational institutions.

Primary education

By January 1, 1872, Stavropol Governorate had in operation 52 public schools, including one two-grade and 51 social schools. In 1872, the region became home to six more schools in the city of Stavropol (subsequent to the coming into force of the Instruction of October 29, 1871) and 16 rural social schools (Sbornik statisticheskikh svedenii, 1873: 40). The Instruction of October 29, 1871 was to transfer the region's grammar schools and parochial schools to the purview of the Ministry of Public Education. Specifically, in 1878 as many as 50 rural grammar schools in Stavropol Governorate became ministerial schools (Obzor, 1880: 55). Despite the region's positive dynamics in the area of primary education, lots of work still had to be done in this domain. In 1883, out of the governorate's 124 volost local government heads just 23 were more or less literate, i.e. knew how to read and write (Otchet, 1884: 49). Table 3 provides statistical data on educational institutions under the Ministry of Public Education and their student body in Stavropol Governorate in the period 1872–1900.

Table 3. Numbers of Primary Schools under the Ministry of Public Education and Students in Them in Stavropol Governorate in the Period 1872–1900 (Sbornik statisticheskikh svedenii, 1873: 40; Otchet, 1885: applications; Otchet, 1886: applications; Otchet, 1887: 272, 296; Otchet, 1890: № 296, 311; Otchet, 1891: № 315, 330; Otchet, 1892: № 317, 332; Otchet, 1893: № 318, 333; Otchet, 1894: № 318, 333; Otchet, 1895: № 318, 333; Otchet, 1896: 476, 506; Otchet, 1897: 506, 536; Otchet, 1899: 486, 516; Otchet, 1900: 536, 566; Otchet, 1901: 536)

Year	Number of schools	Number of students		
		Boys	Girls	Total
1872	74	2,256	486	2,742
1883	136	5,194	874	6,068
1884	139	5,442	925	6,367
1885	140	5,883	1,447	7,330
1886	144	6,074	1,660	7,734
1889	140	6,178	1,287	7,460
1890	146	6,621	1,289	7,910
1891	149	6,557	1,683	8,240
1892	151	6,789	1,724	8,518
1893	154	6,828	1,706	8,534
1894	158	6,887	2,142	9,029
1895	163	7,241	2,309	9,550
1896	172	8,015	2,490	10,505
1898	214	9,375	2,802	12,177
1899	224	10,325	2,876	13,201
1900	242	10,825	3,116	13,941

As evidenced in Table 3, in the period under review, the number of educational institutions in Stavropol Governorate increased three times, and the number of students in them grew five times. Taking into account natural population increase in the governorate and the 28-year time interval, these figures do not seem very high. This may be attributed to the fact that the region had many lowly populated areas in it, with the Ministry being in no position to open schools due to the low number of students. This gap would have to be filled by schools under the Ecclesiastical Department. In 1884, Emperor Alexander III signed into law The Rules for Parochial Schools. From that moment, the region witnessed an upsurge in the establishment of grammar schools and parochial schools under the Ecclesiastical Department (Table 4). Note that, in terms of curricula, education provided by parochial schools was generally similar to that provided by primary ministerial schools, for the exception of advanced study of God's Law.

It is also worth remembering that the overall number of primary educational institutions in the region does not include Armenian-Gregorian schools, schools under the Military Department, and Muslim schools. Specifically, in 1889 the governorate had in operation four Armenian-Gregorian primary schools (Otchet, 1890: № 318), one school under the Military Department (Otchet, 1890: № 319), and five Muslim schools (Otchet, 1890: № 320). In 1890, there now were eight Armenian-Gregorian schools in the region (Otchet, 1891: № 337), with all the Moslem schools in it having ceased operation (Otchet, 1891: № 339). In 1891, the number of Armenian-Gregorian schools in the region dropped two times – to four (Otchet, 1892: № 339), with no Muslim schools in operation there (Otchet, 1892: № 341). There were no Muslim schools in the region in 1893 as well (Otchet, 1893: № 343). In 1894, the number of Armenian-Gregorian schools in the region dropped two times again – to two (Otchet, 1895: № 340), with no Muslim schools in operation there (Otchet, 1895: № 342). In 1895, as many as 12 Muslim schools were established in the region (Otchet, 1896: 526). In 1896, there was just one Armenian-Gregorian school in the region (Otchet, 1897: 552), while there were 30 Muslim schools there (Otchet, 1897: 556). Starting in 1897, data on Armenian-Gregorian and Muslim schools in the region were no longer included in the statistics, as the schools were strictly ecclesiastical.

Table 4 illustrates the scale of work carried out in the area of public education in Stavropol Governorate in the period 1878–1900.

Table 4. Number of Educational Institutions in Stavropol Governorate in the Period 1878–1900 (Obzor, 1879: 42; Obzor, 1880: 52; Obzor, 1884: 48; Otchet, 1890: № 288; Otchet, 1891: № 307; Otchet, 1892: № 309, 340; Otchet, 1893: № 310, 341; Otchet, 1894: № 310, 341; Otchet, 1895: № 310, 341; Otchet, 1896: 458, 524; Otchet, 1897: 488, 554; Otchet, 1899: 468; Otchet, 1900: 518; Otchet, 1901: 518; Vsepoddanneishii otchet, 1901: 63; Vsepoddanneishii otchet, 1902: 63; Vsepoddanneishii otchet, 1903: 66; Vsepoddanneishii otchet, 1899: 70; Vsepoddanneishii otchet, 1898: 139)

Year	Secondary		Schools						Total
				Primary					
	Ministry of Public Education	Military schools	Lower schools	Ministry of Public Education	Private schools	Parochial schools	Grammar school	Schools under other departments	
1878	4	1	2	100	N/A*	N/A	N/A	N/A	132
1879	4	1	2	123	12	N/A	N/A	N/A	142
1882	4	1	2	128	N/A	N/A	N/A	N/A	157
1883	4	1	2	133	N/A	N/A	N/A	N/A	170
1889	5	1	2	140	6	71	N/A	9	234†
1890	5	1	2	146	11	59	N/A	8	232‡
1891	5	1	2	149	7	97	N/A	4	265§
1892	5	1	2	151	8	121	N/A	-	288**
1893	5	1	2	154	7	131	N/A	-	300††
1894	5	1	2	158	6	142	214	2	530
1895	5	1	2	163	7	174	279	12	643
1896	5	1	2	172	8	198	278	31	695
1898	6	1	3	214	8	349	293	-	874
1899	6	1	3	224	7	370	349	-	960
1900	6	1	3	242	4	386	375	-	1,017

The data provided in Table 4 is incomplete, which is due to the fact that statistical information was gathered by different departments, which tended to include or omit particular figures at their own discretion. For instance, from 1889 to 1893 absolutely no data were published on grammar schools in the governorate. The report by the Trustee of the Caucasus Educational District for the period 1889–1893 mentions parochial schools. The operation of these schools would have a significant effect on the development of primary education in the region‡‡. In 1895, the number of parochial schools under the Ecclesiastical Department alone surpassed the number of ministerial primary schools in the region. Subsequently, data on parochial schools were no longer provided in reports by the Trustee of the Caucasus Educational District.

Of particular interest in Table 4 is the number of educational institutions in the region. In the period from 1878 to 1900, this number increased 7.7 times!

To get the most complete picture of the development of the public education system in the region, it is worth examining the size of its student body as well. Specifically, in 1878 the number of students in the region was 7,282 (5,481 boys and 1,810 girls) (Obzor, 1879: 42). All the students

* Data not available.
† Incomplete data. Insufficient data on the region's grammar schools.
‡ Incomplete data. Insufficient data on the region's grammar schools.
§ Incomplete data. Insufficient data on the region's grammar schools.
** Incomplete data. Insufficient data on the region's grammar schools.
†† Incomplete data. Insufficient data on the region's grammar schools.
‡‡ It is to be noted that the Trustee of the Caucasus Educational District did not have purview over educational institutions under the Ecclesiastical Department.

were from the region's 106 ministerial educational institutions and one educational institution under the Military Department. In 1900, the governorate now had in operation 251 ministerial and one military schools, with a combined enrollment of 16,338 (12,283 boys and 4,055 girls). That same year, the region's 761 schools under the Ecclesiastical Department were attended by 31,792 students (21,834 boys and 9,958 girls) (Vsepoddanneishii otchet, 1903: 67). Thus, the governorate had a combined student body of 48,130, with 66.1% of these students attending educational institutions under the Ecclesiastical Department. All in all, in the period from 1878 to 1900 the size of the region's student body increased 6.6 times!

5. Conclusion

In the period 1872–1900, the development of the public education system in Stavropol Governorate was characterized by a number of salient regional features. Specifically, there were many lowly populated areas in the region, which precluded the Ministry of Public Education from creating an extensive network of educational institutions. There was little to no growth in the number of secondary and lower ministerial educational institutions, while, despite some growth, the number of primary schools was insufficient too. In 1884, subsequent to the adoption of The Rules for Parochial Schools, the governorate witnessed an upsurge in the establishment of parochial schools and grammar schools under the Ecclesiastical Department. This upsurge was so significant that by 1900 66 % of all students in the region were enrolled in schools run by the Ecclesiastical Department.

References

Cherkasov et al., 2019 – *Cherkasov, A.A., Bratanovskii, S.N., Koroleva, L.A., Zimovets, L.G.* (2019). Development of school education in the Vologda governorate (1725-1917). Part 1. *European Journal of Contemporary Education*. 8(1): 208-214.

Cherkasov et al., 2019a – *Cherkasov, A.A., Bratanovskii, S.N., Koroleva, L.A., Zimovets, L.G.* (2019). Development of school education in the Vologda governorate (1725-1917). Part 2. *European Journal of Contemporary Education*. 8(2): 418-424.

Cherkasov et al., 2019b – *Cherkasov, A.A., Bratanovskii, S.N., Koroleva, L.A., Zimovets, L.G.* (2019). Development of school education in the Vologda governorate (1725-1917). Part 3. *European Journal of Contemporary Education*. 8(3): 624-637.

Cherkasov et al., 2019c – *Cherkasov, A.A., Bratanovskii, S.N., Zimovets, L.G.* (2019). Development of school education in the Vologda governorate (1725-1917). Part 4. *European Journal of Contemporary Education*. 8(4): 973-983.

Magsumov et al., 2018 – *Magsumov, T.A., Artemova, S.F., Balanyuk, L.L.* (2018). Regional problems of public schools in the Russian Empire in 1869-1878 (using an example of the Vyatka Province). *European Journal of Contemporary Education*. 7(2): 420-427.

Magsumov et al., 2018 – *Magsumov, T.A., Artemova, S.F., Ustinova, O.V., Vidishcheva, E.V.* (2018). Public education system in the Caucasus region in the 1850s: Unification and regulation of educational process. *European Journal of Contemporary Education*. 7(3): 598-607.

Natolochnaya et al., 2018 – *Natolochnaya, O.V., Miku, N.V., Zulfugarzade, T.E., Médico, A.* (2018). Highland schools in the Caucasus: Historical background. *European Journal of Contemporary Education*. 7(3): 608-614.

Natolochnaya et al., 2019 – *Natolochnaya, O.V., Bulgarova, B.A., Denisenko, V.N., Volkov, A.N.* (2019). The History of the Public Education System in Vilna Governorate (the Second Half of the 19th and Early 20th Centuries). Part 1. *European Journal of Contemporary Education*. 8(3): 655-664.

Natolochnaya et al., 2019a – *Natolochnaya, O.V., Bulgarova, B.A., Voropaeva, Yu.A., Volkov, A.N.* (2019). The History of the Public Education System in Vilna Governorate (the Second Half of the 19th and Early 20th Centuries). Part 2. *European Journal of Contemporary Education*. 8(4): 964-972.

Peretyatko, Zulfugarzade, 2017 – *Peretyatko, A.Y., Zulfugarzade, T.E.* (2017). Project of reforms proposed for the don public education in the first half of 1860: A.M. Dondukov-Korsakov, Kh.I. Popov, N.I. Krasnov. *European Journal of Contemporary Education*. 6(4): 817-829.

Peretyatko, Zulfugarzade, 2017a – *Peretyatko, A.Y., Zulfugarzade, T.E.* (2017). Higher and secondary education of the don cossacks in the context of the epoch: The time of the great reforms. *European Journal of Contemporary Education*. 6(2): 367-377.

Peretyatko, Zulfugarzade, 2019 – *Peretyatko, A.Y., Zulfugarzade, T.E.* (2019). «66 % of Literacy among the Male Population of School Age Brings it Closer to Common Education» vs «in the Largest Villages, it was Difficult to Meet a Literate Person»: the Main Statistical indicators of Primary Education among Don Cossacks in the XIX c. Part 1. *European Journal of Contemporary Education*. 8(2): 454-465.

Peretyatko, Zulfugarzade, 2019a – *Peretyatko, A.Y., Zulfugarzade, T.E.* (2019). «66 % of Literacy among the Male Population of School Age Brings it Closer to Common Education» vs «in the Largest Villages, it was Difficult to Meet a Literate Person»: the Main Statistical indicators of Primary Education among Don Cossacks in the XIX c. Part 2. *European Journal of Contemporary Education*. 8(3): 664-676.

Shevchenko et al., 2016 – *Shevchenko, N.A., Vidishcheva, E.V., Emelyanova, O.V.* (2016). The establishment of the system of public education in the Caucasus (1802-1917 years): The characteristic features. *Bylye Gody*. 40(2): 363-372.

Magsumov et al., 2020 – *Magsumov, T.A., Korolev, A.A., Ponomareva, M.A., Zulfugarzade, T.E.* (2020). The System of Public Education in Kars Oblast in the Period 1878–1917. Part 1. *European Journal of Contemporary Education*. 9(1): 221-234.

Molchanova et al., 2019 – *Molchanova, V.S., Balanyuk, L.L., Vidishcheva, E.V., Potapova, I.I.* (2020). The Development of Primary Education on the Cossack Territories in 1803–1917 years (on the Example of the Kuban Region). Part 1. *Bylye Gody*. 53(3): 1049-1058.

Molchanova et al., 2019a – *Molchanova, V.S., Balanyuk, L.L., Vidishcheva, E.V., Potapova, I.I.* (2020). The Development of Primary Education on the Cossack Territories in 1803–1917 years (on the Example of the Kuban Region). Part 2. *Bylye Gody*. 54(2): 1524-1536.

Molchanova et al., 2020 – *Molchanova, V.S., Balanyuk, L.L., Vidishcheva, E.V., Potapova, I.I.* (2020). The Development of Primary Education on the Cossack Territories in 1803–1917 years (on the Example of the Kuban Region). Part 3. *Bylye Gody*. 55(1): 88-104.

Mamadaliev et al., 2018 – *Mamadaliev, A.M., Gordeev, I., Miku, N.V., Médico, A.* (2018). Teacher training for the system of primary education in Switzerland in the mid-nineteenth century. *European Journal of Contemporary Education*. 8(1): 222-228.

Mamadaliev et al., 2019 – *Mamadaliev, A.M., Svechnikova, N.V., Miku, N.V., Médico, A.* (2019). The German System of Public Education in the Period between the 15th and Early 20th Centuries. Part 1. *European Journal of Contemporary Education*. 8(2): 445-453.

Natolochnaya et al., 2020 – *Natolochnaya, O.V., Zimovets, L.G., Allalyev, R.M., Svechnikov, V.A.* (2020). The System of Public Education in Stavropol Governorate in the Period 1804–1917. Part 1. *European Journal of Contemporary Education*. 9(2): 473-480.

Sbornik statisticheskikh svedenii, 1873 – Sbornik statisticheskikh svedenii o Stavropol'skoi gubernii [A collection of statistical data about the Stavropol province]. Vyp. 5. Stavropol', 1873. [in Russian]

Obzor, 1879 – Obzor Stavropol'skoj gubernii za 1878 g. [Overview of the Stavropol province for 1878]. Stavropol', 1879. [in Russian]

Obzor, 1880 – Obzor Stavropol'skoj gubernii za 1879 g. [Overview of the Stavropol province for 1878]. Stavropol', 1880.

Obzor, 1884 – Obzor Stavropol'skoj gubernii za 1883 g. [Overview of the Stavropol province for 1883]. Stavropol', 1884.

Otchet, 1885 – Otchet popechitelya Kavkazskogo uchebnogo okruga o sostoyanii uchebnykh zavedenii za 1884 g. [Report of the trustee of the Caucasian educational district on the state of educational institutions for 1884]. Tiflis, 1885. [in Russian]

Otchet, 1886 – Otchet popechitelya Kavkazskogo uchebnogo okruga o sostoyanii uchebnykh zavedenii za 1885 g. [Report of the trustee of the Caucasian educational district on the state of educational institutions for 1885]. Tiflis, 1886. [in Russian]

Otchet, 1887 – Otchet popechitelya Kavkazskogo uchebnogo okruga o sostoyanii uchebnykh zavedenii za 1886 g. [Report of the trustee of the Caucasian educational district on the state of educational institutions for 1886]. Tiflis, 1887. [in Russian]

Otchet, 1890 – Otchet popechitelya Kavkazskogo uchebnogo okruga o sostoyanii uchebnykh zavedenii za 1889 g. [Report of the trustee of the Caucasian educational district on the state of educational institutions for 1889]. Tiflis, 1890. [in Russian]

Otchet, 1891 – Otchet popechitelya Kavkazskogo uchebnogo okruga o sostoyanii uchebnykh zavedenii za 1890 g. [Report of the trustee of the Caucasian educational district on the state of educational institutions for 1890]. Tiflis, 1891. [in Russian]

Otchet, 1892 – Otchet popechitelya Kavkazskogo uchebnogo okruga o sostoyanii uchebnykh zavedenii za 1891 g. [Report of the trustee of the Caucasian educational district on the state of educational institutions for 1891]. Tiflis, 1892. [in Russian]

Otchet, 1893 – Otchet popechitelya Kavkazskogo uchebnogo okruga o sostoyanii uchebnykh zavedenii za 1892 g. [Report of the trustee of the Caucasian educational district on the state of educational institutions for 1892]. Tiflis, 1893. [in Russian]

Otchet, 1894 – Otchet popechitelya Kavkazskogo uchebnogo okruga o sostoyanii uchebnykh zavedenii za 1893 g. [Report of the trustee of the Caucasian educational district on the state of educational institutions for 1893]. Tiflis, 1894. [in Russian]

Otchet, 1895 – Otchet popechitelya Kavkazskogo uchebnogo okruga o sostoyanii uchebnykh zavedenii za 1894 g. [Report of the trustee of the Caucasian educational district on the state of educational institutions for 1894]. Tiflis, 1895. [in Russian]

Otchet, 1896 – Otchet popechitelya Kavkazskogo uchebnogo okruga o sostoyanii uchebnykh zavedenii za 1895 g. [Report of the trustee of the Caucasian educational district on the state of educational institutions for 1895]. Tiflis, 1896. [in Russian]

Otchet, 1897 – Otchet popechitelya Kavkazskogo uchebnogo okruga o sostoyanii uchebnykh zavedenii za 1896 g. [Report of the trustee of the Caucasian educational district on the state of educational institutions for 1896]. Tiflis, 1897. [in Russian]

Otchet, 1899 – Otchet popechitelya Kavkazskogo uchebnogo okruga o sostoyanii uchebnykh zavedenii za 1898 g. [Report of the trustee of the Caucasian educational district on the state of educational institutions for 1898]. Tiflis, 1899. [in Russian]

Otchet, 1900 – Otchet popechitelya Kavkazskogo uchebnogo okruga o sostoyanii uchebnykh zavedenii za 1899 g. [Report of the trustee of the Caucasian educational district on the state of educational institutions for 1899]. Tiflis, 1900. [in Russian]

Otchet, 1901 – Otchet popechitelya Kavkazskogo uchebnogo okruga o sostoyanii uchebnykh zavedenii za 1900 g. [Report of the trustee of the Caucasian educational district on the state of educational institutions for 1900]. Tiflis, 1901. [in Russian]

Vsepoddanneishii otchet, 1898 – Vsepoddanneishii otchet ober-prokurora svyateishego sinoda po vedomstvu pravoslavnogo ispovedaniya za 1894 i 1895 gg. [The most submissive report of the chief prosecutor of the holy synod for the department of orthodo confession for 1894 and 1895]. SPb., 1898. [in Russian]

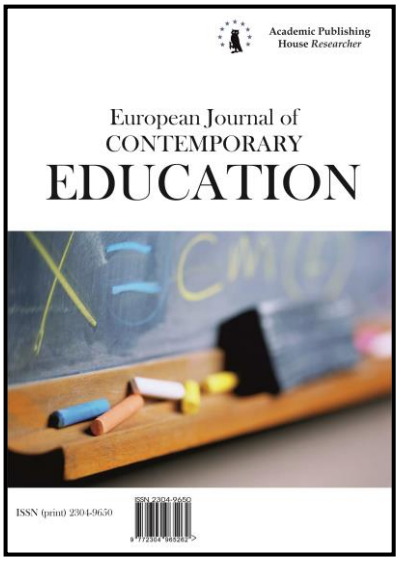
Vsepoddanneishii otchet, 1899 – Vsepoddanneishii otchet ober-prokurora svyateishego sinoda po vedomstvu pravoslavnogo ispovedaniya za 1896 i 1897 gg. [The most submissive report of the chief prosecutor of the holy synod for the department of orthodo confession for 1896 and 1897]. SPb., 1899. [in Russian]

Vsepoddanneishii otchet, 1901 – Vsepoddanneishii otchet ober-prokurora svyateishego sinoda po vedomstvu pravoslavnogo ispovedaniya za 1898 g. [The most submissive report of the chief prosecutor of the holy synod for the department of orthodo confession for 1898]. SPb., 1901. [in Russian]

Vsepoddanneishii otchet, 1902 – Vsepoddanneishii otchet ober-prokurora svyateishego sinoda po vedomstvu pravoslavnogo ispovedaniya za 1899 g. [The most submissive report of the chief prosecutor of the holy synod for the department of orthodo confession for 1899]. SPb., 1902. [in Russian]

Vsepoddanneishii otchet, 1903 – Vsepoddanneishii otchet ober-prokurora svyateishego sinoda po vedomstvu pravoslavnogo ispovedaniya za 1900 g. [The most submissive report of the chief prosecutor of the holy synod for the department of orthodo confession for 1900]. SPb., 1903. [in Russian]

Published in the Slovak Republic
European Journal of Contemporary Education
E-ISSN 2305-6746
2020, 9(3): 689-706
DOI: 10.13187/ejced.2020.3.689
www.ejournal1.com



Revisiting the History of Pedagogical Thought in Russia's South: the Pedagogical Beliefs of Major Pedagogues at the Novocherkassk Gymnasium in the 19th century. Part 2

Artyom Yu. Peretyatko [a, b, *], Teymur E. Zulfugarzade [c]

[a] International Network Center for Fundamental and Applied Research, Washington, USA
[b] Volgograd State University, Volgograd, Russian Federation
[c] Russian Economic University named after G.V. Plekhanov, Moscow, Russian Federation

Abstract

Recent years have witnessed the publication of a variety of scholarly papers highlighting region-specific peculiarities of education in the Russian Empire. However, they tend to focus on statistical information regarding the number of schools, the number of students, etc. Therefore, theoretical and pedagogical views and unique features of the methodological work done by major provincial teachers remain poorly researched. The paper discusses the case study of the Novocherkassk Gymnasium that was the most prominent scientific and educational center in the Don region in the 19th century and that boasted a teaching personnel of renowned local figures. Remarkably, the material on the actual pedagogical process in the gymnasium was already collected before 1917, mainly in the initiative to celebrate the facility's centenary, and as many appropriate documents lacked, much attention was paid to gathering information from former gymnasium students. As a result, the knowledge of real teaching practices used in the gymnasium is based both on official documents and on informal, often critical, accounts by contemporaries of its teachers, and the group of teachers include persons who played an important role in the Don history.

The second part of the paper is dedicated to the evolution of theoretical pedagogical thought and educational methods in the Novocherkassk Gymnasium from 1810 to 1850. The paper demonstrates that the educational process became relatively streamlined only since this period – this happened at the end of 1830 when I.Ya. Zolotarev, the first Don Cossack, who taught at a higher educational institution (Kharkov University), was appointed its director. It was he who introduced for teachers regular reporting on class attendance, topics covered, firmly required teachers to prepare curricula and drove other changes. Parallel to the process, there were shifting theoretical views of

* Corresponding author
E-mail addresses: artperetatko@yandex.ru (A.Yu. Peretyatko)

Novocherkassk teachers as advocates of practice-oriented and applied education, helpful in building a career, strengthened their position. The Novocherkassk gymnasium was envisioned as a "military" educational institution that served the interests of the Don Host by training officers and administrators. However, the plans were hindered by excessive formalism in teaching, lack of focus on actual cognitive abilities of children and too a scholastic educational process that had no touch with reality. By 1850, a certain development crisis had began looming over the Novocherkassk Gymnasium: the number of people willing to be students at practice-oriented courses gradually went down while the needs of the Don Host were not addressed.

Keywords: history of pedagogy, teaching methods, historical pedagogical views, Novocherkassk Gymnasium, T.I. Selivanov, I.Ya. Zolotarev.

1. Introduction

In 1907, the Don Host's regional printing house published a substantial book by priest I.P. Artinsky, which described the history of the Novocherkassk Gymnasium. The author specifically emphasized in the preface that "the word 'gymnasium' in the title of the treatise is also defined using the adjective 'military', in addition to the attribute 'Novocherkassk'" (Artinskii, 1907: V). Indeed, the Novocherkassk Gymnasium was a center of thought first for the Land and later for the Oblast of the Don Host over many years, and its graduates and teachers included the majority of Don academics, writers and public figures of the 19th century. It is hardly surprising that for the gymnasium's 100th anniversary in 1905, the local authorities made efforts to uncover and structure materials on the history of the institution. It early became clear that only few such materials survived: the gymnasium archive was damaged in fire in 1858, later its files and records were actively sold out by negligent employees, and most gymnasium directors failed to keep systematic records of their activities (Artinskii, 1907: IV). In this situation, the pedagogical council decided to ask I.P. Artinskii to help find information on the gymnasium's past, and to this end, the latter contacted Don historians and local lore experts, many of whom once were students at the institution (Artinskii, 1907: IV). The outcome of the request was Artinskii's book that was, therefore, based not only on official information, but also on the accounts provided by former students of the Novocherkassk Gymnasium.

We should say that I.P. Artinskii was not the first person whom the lack of sources on the history of the Don education prompted to use eyewitness accounts, the "oral history", as defined by modern terminology. In 1859, a small book "Essays of the Don" by A.G. Filonov, which brought to light interesting facts from the past and present of the Don Cossacks in a somewhat haphazard manner. The last of the essays was entitled "Educational Institutions on the Don (from 1790 to 1807)" and was grounded, among other things, in the "unwritten accounts" given by several old men, of whom the author specifically singled out Esaul M.O. Nazarov, who in 1790 was accepted into the Don Principal Public School, later re-organized into the Novocherkassk Gymnasium (Filonov, 1859: 151-152).

So, we can now benefit from a fascinating first-hand source of information on the Don Host's most important educational facility of the 19th century, a center of the intellectual life of the Don Cossacks. We thought it might be valuable to systematize the available evidence of how influential figures in the Don history carried on their teaching practice in the Novocherkassk Gymnasium and what theoretical pedagogical views they conveyed. It is also noteworthy that, as we will see below, for all its major role in the region, the Novocherkassk Gymnasium was rather an ordinary provincial school for the Russian Empire, and, moreover, the one that was chronically underfunded. With our research, we will be able to take a glance at famous Don figures from an unexpected angle by reviewing their pedagogical talents, as well as to better understand what methodology served as a basis for the learning process in the Russian province of the last century.

A relevant note should be made here that historians have become markedly more interested in recent years in studying the region-specific features of pre-revolutionary education in Russia. Articles and article series on the education system development in the Vilna Governorate (Natolochnaya et al., 2019a; Natolochnaya et al., 2019b), Vologda Governorate (Cherkasov et al., 2019a; Cherkasov et al., 2019b; Cherkasov et al., 2019c; Cherkasov et al., 2019d) and in the Caucasus (Shevchenko et al., 2016) have been published in recent years. Researchers are also striving to identify features of the primary education system in the Cossack territories (Molchanova et al., 2019a; Molchanova et al., 2019b; Molchanova et al., 2020). On the other hand, the

experience of individual provincial pedagogues, which was greatly appreciated by contemporaries, has received only cursory learned attention so far. However, the large number of outstanding graduates of the Novocherkassk Gymnasium shows that the experience deserves careful examination, at the very least.

2. Materials and methods

Only the least amount of information on the Novocherkassk Gymnasium in 1810 and 1850 (it is the period that the second part of our paper deals with) has survived to our days. A.G. Filonov, who created his works in the middle of the 19th century, did not collect information on the immediate past; and by the early 20th century, when I.P. Artinskii set out to his research journey, too few people still lived who were students and teachers at the gymnasium in those years. This is why the primary source for this part of our paper will constitute materials from the gymnasium archive, made public by I.P. Artinskii (Artinskii, 1907). Thankfully, latter not only quoted many excerpts from the official correspondence of the gymnasium's director, I.Ya. Zolotarev, in his book, but also enclosed verbatim records of official speeches made by some of the gymnasium teachers, beginning in 1846 (Artinskii, 1907: 355-419). Despite all the limitations of such materials, they allow for a possibility to provide a general evaluation of the changes that evolved in the pedagogical views of teachers at the Novocherkassk Gymnasium in the period under review.

The most fragmented picture, that I.I. Artinskii reflected in his book, refers to the period from 1820 to 1830. Fortunately, the second of the decades is described in a little-known and very important source that still exists today. The Pushkin Central Library in Novocherkassk preserved a mysterious manuscript “Speeches delivered in the ceremonial meetings in the Novocherkassk gymnasium since 1832” (Rechi, proiznesennye v torzhestvennykh sobraniyakh Novocherkasskoi gimnazii s 1832 goda) (Rechi..., b. g.). Who wrote down the speeches, why he did it, why only speeches at ceremonial meetings in the gymnasium from 1832 to 1837 were recorded – we can only guess the answers to the questions. It is so much stranger that I.P. Artinsky never made the slightest mention of the manuscript: apparently, “Speeches” were not stored in the gymnasium archive before the revolution but in some private collection and remained unknown to researchers. Nevertheless, the text plays a crucial role both as the earliest document that provides the complete public speeches of ordinary, average teachers of the Novocherkassk Gymnasium, rather than those of prominent figures like A.G. Oridovsky, and as evidence of the dynamically evolving pedagogical views of Novocherkassk teachers in the 1830s. By using the historical-descriptive method, citing the key provisions of the manuscript, which has not previously been reviewed by scholars, comparing them with other sources on the basis of the historical-comparative method, and finally, by employing historical analysis to explore the information given by I.P. Artinskii, we succeeded in delivering a relatively accurate reconstruction of the changes in the pedagogical theory and pedagogical practices in the Novocherkassk Gymnasium in 1810–1850.

3. Discussion

We do not put down the history of the Novocherkassk Gymnasium here, but it will be difficult to comprehend the stagnation in the pedagogical views of its teachers if we fail to consider the fact that three events most adverse for the Don education occurred in 1810. The Patriotic War of 1812 was most large-scale of them, during which young Cossacks joined the Don militia en masse, inspired by a patriotic uplift. We mentioned the family boarding house of the Krasnov family in the first part of our paper. I.I. Krasnov described with deep emotion how his students lived “between fear and hope” to go to the field army with their grandfather, how he, yielding to their desire, agreed to take all the children with him, and only the entreaties of more prudent relatives persuaded him to leave the Cossack boys under twelve at home (Vospominaniya..., 1873: 376-377). The children of other generals, who were far under the military service age, also went into the army (Vospominaniya..., 1873: 378). One cannot but agree with I.P. Artinskii, who wrote that “tumultuous circumstances of the war, which swept up most of the population for the military service” came as a crushing blow for the Novocherkassk Gymnasium that lost many students (Artinskii, 1907: 74).

The outbreak of war seemed to completely push the death of A. G. Oridovsky, the “first distinguished teacher” of the Land of the Don Host, which happened on March 11, 1812, into the background in the memory of contemporaries (Artinskii, 1907: 14). We were unable to uncover any

information in the works by contemporaries either on the death itself, or on the reaction it produced in Don society. But it is perfectly obvious that the death of the leading "advocate of education" on the Don should mean a significant loss in the influence and popularity for the Novocherkassk Gymnasium.

Lastly, it became clear in the same 1812 that the Don authorities very often adopted an unfavorable attitude to the gymnasium, and in fact, its director, A.G. Popov only managed to build positive relations with Ataman M.I. Platov, but not with people who surrounded him. In 1812–1813, A.K. Denisov who acted for the ataman who commanded the Cossacks in the fight against Napoleon, orchestrated a number of attempts to completely bring the gymnasium under his total control and even force part of its teachers to transfer from civil ranks to the military (Artinskii, 1907: 63-65). The situation only deteriorated over time, especially after the death of M.I. Platov, when A.K. Denisov became a full-fledged Don Ataman. Just a few months after his appointment, he required A.G. Popov to resign from his post of the Novocherkassk Gymnasium director, qualifying the latter as "a man of honest rules, but the one who, due to his disposition, limited knowledge and lack of affinity for this service, is unable to see the accuracy of the educational order" (Artinskii, 1907: 68). The Kharkov educational district succeeded in defending A.G. Popov, and to this end even dauntlessly accused A.K. Denisov of lying: his officials reminded the higher authorities that the director of the Novocherkassk Gymnasium was "well educated in the sciences he teaches at the Moscow University", and that "no complaints so far about Director Popov have ever reached the authorities from anyone" (Artinskii, 1907: 69-70). Nevertheless, in the summer of 1819, an educational district trustee personally came to the Don, and a rigorous check of students' knowledge was conducted (L.B., 1906: 57-58). Against the background of such coldness between the military authorities and the gymnasium, it is not surprising at all that the funds promised by M.I. Platov for a robust gymnasium building, were never allocated (Artinskii, 1907: 71). As a result, conditions in which teachers had to conduct classes left much to be desired and in the 1820s, for example, V.D. Sukhorukov described the premises as "makeshift outbuildings", "very cramped and with shabby appearance" (Sukhorukov, 1891: 139).

In addition, the period between 1810 and 1820 failed to resolve the central pedagogical issue that became clearly visible at the first stage of the existence of the Novocherkassk Gymnasium – the issue of the mostly incompetent teaching staff. I.Ya. Zolotarev, appointed the head of the Don educational institutions in 1830, gave the following description of the situation he faced: "In the gymnasium itself, the exception was one or two teachers, while the rest were totally inept at performing their job duties" (Artinskii, 1907: 76). All indications are that the last drop was the resignation of A.G. Popov in 1824: the director was past sixty, he lost his beloved wife by death, his health was damaged, and he decided to retire (L.B., 1906: 58). Already in the next year, the library and dedicated classrooms, which the previous head continuously struggled to replenish, were destroyed by fire, and search for a new director, who would agree to such an unfavorable position and have the minimum competencies required for it, took five years (Artinskii, 1907: 76).

In the context of all the events, the enrollment in the Novocherkassk Gymnasium almost did not grow as well. Of course, one could hardly expect an inflow of students into an educational institution with knowingly incompetent teachers and without its own premises and special-purpose equipment. This rather once again underscores the importance of the work done by A.G. Popov and A.G. Oridovsky in 1800 – thanks to it the gymnasium managed to survive even in these harsh conditions, and the outflow of student was always followed by an increase. We will provide below a chart showing the number of students in the Novocherkassk Gymnasium in 1800-1830, and as will be shown in the chart by the middle of 1830, the school had only slightly more children than in 1800, at the time of A.G. Oridovsky's speeches about the benefits of education.

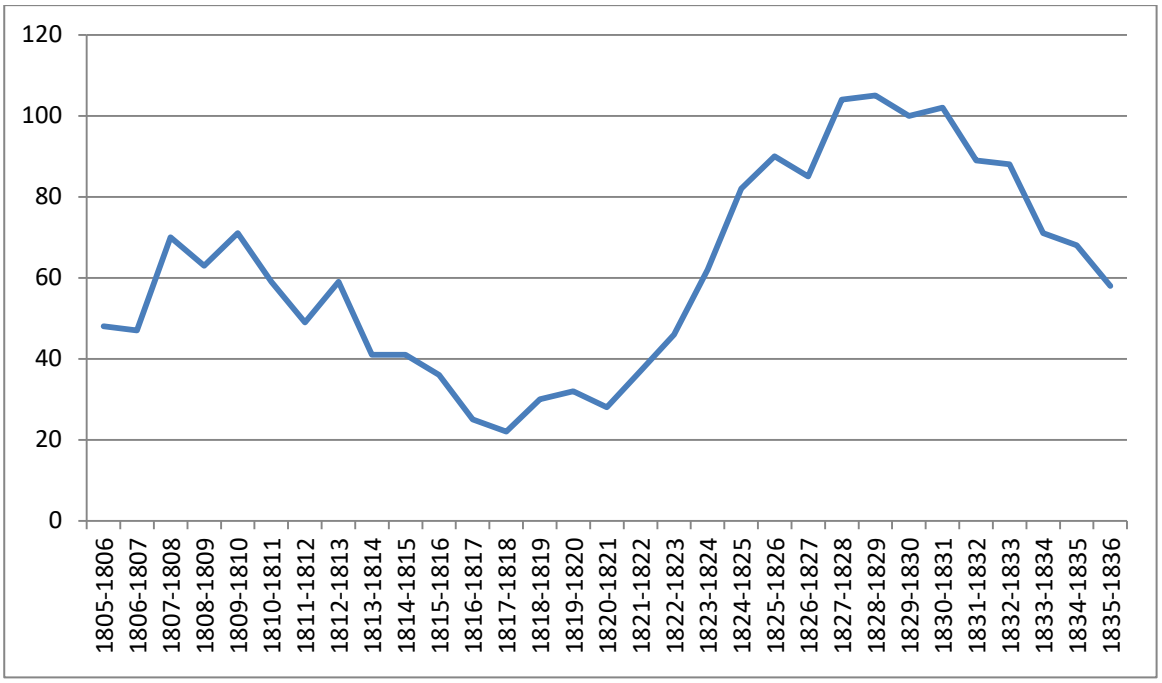


Fig. 1. Trends in the number of students in the Novocherkassk Gymnasium. 1805-1836. Source: Artinskii, 1907: 76

Thus, in the period from 1812 to 1836, the Novocherkassk Gymnasium simply did it best not to perish, and its teachers had other things to worry about rather than about pedagogical theories or new teaching practices. The stagnating pedagogical views of Novocherkassk teachers were also brought about by the fact that after A.G. Popov's resignation, no other prominent figures remained in the Don region, and even the new gymnasium director, T.I. Selivanov, appointed in 1829, apparently, turned out to be a completely colorless person, since even I.P. Artinskii did not give any specific information on the man.

However, just at the end of this period of inertia, the teachers of the Novocherkassk Gymnasium began to shift away from the clearly outdated pedagogical ideas of A.G. Popov and A.G. Oridovsky, looking for innovative educational concepts whose outlines were often not yet completely clear to the agents of change themselves. The progression can be easily traced in the above-mentioned "Speeches delivered in the ceremonial meetings in the Novocherkassk gymnasium since 1832". While the earliest of the speeches relied on the idea of moral self-improvement and approaching to God through education, were idealized and overfilled with poorly conceptualized rhetoric and in general were highly reminiscent of the extant texts of A.G. Oridovsky, the later speeches showed clear signs of a turn towards practice-oriented ideals of education.

The collection of speeches opens with a speech by history teacher V.A. Kallistratov, under the declarative title "On the importance of teaching profession". As for V.A. Kallistratov, little is known about the person: after several years of work in the Don region, he was transferred to the Kursk Gymnasium, and then took the position of inspector at the Tambov Gymnasium (Artinskii, 1907: 330; Kholodnyi, 1886: 142). Thus, unlike A.G. Popov, who was originally a military official, and A.G. Oridovsky, the unofficial leader of the Don clergy, V.A. Kallistratov was a trained teacher who had a corresponding work experience in several provinces of the Russian Empire. Speaking of the content of his speech, it had few connections with the title. V.A. Kallistratov mainly spoke about the vital role of education in general – he even failed to suggest a conceptual and stylistic development for Oridovsky's ideas but, to be more precise, simply repeated the proposition of the Protoiereus that "man is the image of the invisible divine being; <...> but this godlike man humbles oneself greatly if he is left without nourishment for his talents" (Filonov, 1859: 170-171). Here is the definition, for example, the history teacher gave to the term "education": "The only instrument that by destroying the rough crust that constrains the inner abilities of a man and gradually expanding

the range of his moral activity, paves the way unimpeded to the purest concept of virtue, Truth and God" (Rechi..., b. g.: 30b.-4). Accordingly, most of the arts and sciences (namely, "physics, philology, general history of human race, natural history, etc.") were interpreted by V.A. Kallistratov as "a replication of the earth and heavens", as a path to the "purest idea of God" (Rechi..., b. g.: 6). And finally, the teacher, according to V.A. Kallistratov, was supposed to act as a "moral educator for the mind and heart of inexperienced youths" (Rechi..., b. g.: 30b.). Of course, the speech did not elaborate on any qualities required for a teacher nor did it clarify on the requirements for teachers. Therefore, the speech "On the importance of teaching profession" is an illustrative example of the stagnation that pervaded the pedagogical views of Don teachers and lasted from 1800 until the early 1830s: it only paraphrased things long known to the audience, which by the time had become common not only in Western countries and Russian capitals, but on the Don as well. If V.A. Kallistratov's speech conveyed any substantially novel ideas, they were expressed in a number of hesitating statements about the teacher's role underestimated by society. "This modest title is not too enviable, brilliant or big," V.A. Kallistratov admitted but immediately lapsed into elevated rhetoric about the "internal delirious pleasure" that the teaching profession gives (Rechi..., b. g.: 30b.).

A speech "On the sublime" by another gymnasium teacher, V. Kondratyev, was very akin to V.A. Kallistratov's speech. Even less information on the former has survived to this day: we know neither the details of his biography, nor even his patronymic, only that V. Kondratyev taught natural history and physics at the Novocherkassk Gymnasium (Artinskii, 1907: 310). The teacher devoted his speech to "the overview of the great, diverse and wise Divine creations which truly instill a feeling of love and reverence for the author of our existence in the heart of man" (Rechi..., b. g.: 11ob.). We can conclude that V. Kondratyev was also a supporter of the doctrine about the predominant religious and moral significance of education. And yet, the speech "On the sublime" marks a crucial step forward as compared to A.G. Oridovsky and V.A. Kallistratov: V. Kondratyev believed not some abstract "sciences", but natural history, a specific discipline with its unique features, to a path to religious self-improvement. Although still very tentatively and clumsily, V. Kondratyev emphasized that the coming generation especially needs natural sciences because they teach to scrutinize the world around and rest upon "experiments and observations" (Rechi..., b. g.: 10ob.). He also sought to explain the educational role of two other major sciences, history and mathematics. For example, from his perspective, history was important as "not only does it reveals the picture and progression of events and circumstances that happen to major states, it instructs us in penetrating into the very essence of them" (Rechi..., b. g.: 22ob. 10ob.). Mathematics taught "to combine theoretical knowledge with practice," V. Kondratyev wrote (Rechi..., b. g.: 10ob.). But, perhaps, the most indicative detail in V. Kondratyev's speech was that, after he finished with eloquent speculations about the sublime God and nature, he did not draw a conclusion, but straightforwardly addressed the "Don Host administration", begging officials to "enhance funding" allocated for the gymnasium that was badly needed by Don Cossacks (Rechi..., b. g.: 19). The teacher of natural sciences seemed to worry much more about real-world problems than about the abstract discourse about God, but, with all restraints imposed by the tradition of public speeches, he had to verbosely describe the sublime of God only to jump from the ground to an unexpected conclusion about the need to increase funding for the Novocherkassk Gymnasium where they studied God's glorious creations.

Individual cautious elements of novelty in the speeches, made by V.A. Kallistratov and V. Kondratyev in the first half of 1830 (1832 and 1833, respectively), set the stage for the way for a truly revolutionary speech by teacher of mathematics G. Rylsky in 1835. At an official test of knowledge taken by gymnasium students, the teacher spoke for the first time about the purely practical benefits received through the application of a specific science, about how graduates could put the knowledge gained to use in their careers, with no references at all to moral self-improvement and the more intimate connection between an educated person and God. Instead, G. Rylsky identified the following "key applications" of pure mathematics in contemporary society:

1) "In surveying and demarcating lands" (Rechi..., b. g.: 22ob.).

2) "In trade" (Rechi..., b. g.: 24).

3) To calculate bank interest (Rechi..., b. g.: 25).

4) "In mixing silver or gold of two or more standards to receive a certain amount of silver of the desired standard" (Rechi..., b. g.: 28).

There was almost no rhetorical flourish and generalities in G. Rylsky's speech. But the mathematics teacher pointed out for the first time in the practice of such speeches, which branches of his science and which special tools would serve best his students in succeeding in various fields of practical activity. Let us confine ourselves to one example. While describing the work of land surveyors, G. Rylsky mentioned that "it is even better if he (land surveyor – A.P., T.Z.), with a good command of the initial principles of rectilinear trigonometry, logarithms of numbers and trigonometric lines, employs the astrolabe in addition to chains and stakes" (Rechi..., b. g.: 23). One can hardly conceive of a more striking contrast to the speeches by the "old school" Novocherkassk teachers who abstractly elaborated on the divine goodness of sciences. However, there was no complete break off with their ideas, but there was a radical shift of focus: teachers in the Novocherkassk Gymnasium emphasized since the time of A.G. Oridovsky the moral importance of education as well as mentioned its usefulness in real life, and G. Rylsky in fact only concentrated exclusively on the last proposition, discarding the first one. One consideration that ran through his entire speech was the one about the practical value of education, and the speech even ended with reasoning that students "should not waste time spending it in idleness," because in the future they "will experience applications of all the sciences they were taught to a greater or lesser extent" (Rechi..., b. g.: 29ob.).

It is obviously that G. Rylsky's speech signalized a turning point in the pedagogical views expressed by the majority of teachers in the Novocherkassk Gymnasium. Until 1835, the school's ceremonial meetings heard only speeches on abstract and general topics about the benefits of enlightenment (along with the speeches by V.A. Kallistratov and V.Kondratyev, we should mention the speeches delivered in 1834 by G.G. Mozharov "On enlightenment as a sole source of happiness and glory for a generation that begins its life in the Don Host" (Rechi..., b. g.: 30-36ob.) and by Protoiereus S. S. Saltykov, who once again stressed that sciences "not only enlighten and educate the mind, but also ennoble and elevate the young heart" (Rechi..., b. g.: 21-22). After 1835, speeches were increasingly more devoted to the issues of specific disciplines and more widely promote sciences. In 1836, the same V.A. Kallistratov no longer discussed the general benefits of enlightenment, but made a report "On the gradual rise to power by Russia that secured a leadership position among the states of Europe," on his subject, which, in fact, offered a brief overview of the history of Russia (Rechi..., b. g.: 40-50). In 1837, a teacher of mathematics and physics, I.D. Gamov, spoke with students and guests of the gymnasium "On the necessity to know the laws of nature when studying physical phenomena," introducing the audience to basic physical concepts (Rechi..., b. g.: 68-74).

The fundamental change in the pedagogical views of Novocherkassk teachers can be also demonstrated by the events of 1836, when the local gymnasium was reorganized in compliance with the Gymnasium Charter of 1828. In his official speech on the occasion, Director T.I. Selivanov presented his interpretation of the ongoing reform to "distinguished guests", an interpretation that was quite consistent with the new pedagogical trends. He stressed that thanks to the reform, which significantly broadened the gymnasium curriculum (which was even extended from four to seven years), "children who choose to go to a seven-grade gymnasium, can acquire such a comprehensive knowledge that will empower them to easily enter a university for higher education and apply for a military or civil service where they will be able accomplish any assignment with flying colors" (Rechi..., b. g.: 52ob.). Thus, the Novocherkassk Gymnasium has officially announced a new main purpose of education for students – preparing for entering a university and gaining practical knowledge, rather than moral self-improvement. Moreover, T.I. Selivanov paid a special attention in his speech to the fact that the very program of the gymnasium curriculum was adapted to the Don environment by the Ministry of Public Education, to include subjects relevant for Cossacks in their future careers, such as fencing, gymnastics, court proceedings, artillery and fortification (Rechi..., b. g.: 52ob.-53). We will take the liberty of citing an extensive excerpt from his speech, which clearly demonstrates a more practice-oriented core of Don education: "With what paternal beneficence our Most August Monarch Sovereign himself takes care of the education of young Don Cossacks. It is his wish that along with refining their spiritual abilities, educating their minds and hearts, they will develop their physical strength, and from a very young age, by doing gymnastic exercises, children will improve themselves for their vocation, namely: in horseback riding, in the skill of moving quickly and easily, in deft use of weapons, in training eyes and hands to accurately shoot at a target, in swimming across rivers and in other types of speedy and swift activities

pertaining to the service of Cossacks. In this way, Don's alumni, prepared in this educational institution, when they enter the military profession, would be notable there not only by their fearlessness and valor innate to each Don Cossack, but in places unreachable for valor they would be able to defeat enemies with a great skill and strategic information acquired through the study of military sciences. And when, after accomplishing their military exploits, they return to the bosom of their native land and are called to civil service, then, with the information about the practice of legal proceedings, acquired here, they could fully comprehend the power of laws and defend the honor and life of a citizen. This proves that the children of Don Cossacks cannot receive a better upbringing and education for their military and civilian journey, for their future responsibilities in any other educational institution" (Rechi..., b. g.: 53-530b.).

Consequently, the conflict between the ideas about the unconditional benefit of any education and the actual incompetence of many teachers, which characterized the teaching staff in the Novocherkassk Gymnasium in the first decades of the 19th century, was finally resolved in the 1830s. This change was set in motion through a radical rethink of their pedagogical views by Novocherkassk teachers. The notion of religious and moral benefits of any, even the weirdest and most preposterous learning was now a thing of the past; education was no longer regarded as a peculiar route to God. Education was expected to give useful advantages and provide students with knowledge in specific subjects, and the knowledge would be actionable and instrumental in the future career. Accordingly, a model teacher began to emerge from a "moral educator of the minds and hearts of inexperienced youths" as a teacher of a specific subject, who was perfectly knowledgeable about the subject content and was willing to communicate it to his students.

Such transformation might be caused simply by a physical change of generations of teachers. We mentioned above that Don educational institutions were headed by I.Ya. Zolotarev in 1830, who was fully aware of the problem of teachers' incompetence. According to I.P. Artinskii, under his leadership, the staff of the gymnasium teachers "changed for the better, although, perhaps, not as quickly and definitely as it should be" (Artinskii, 1907: 89). Although the process spanned a period until the 1840s, as we will see below, new teachers often showed much better proficiency in their subjects, and in some cases even carried on research work. In addition, the head of the educational institutions of the Don Host himself was sympathetic to practice-oriented education (Artinskii, 1907: 126). In fact, it seems plausible to assume that the revolutionary change that took place in the Don pedagogical thought in the 1830s, was connected with the personality of I.Ya. Zolotarev. Unfortunately, this advocate of Don enlightenment did not attract even such scant attention of historians, which was paid to A.G. Popov and A.G. Oridovsky – there are no special works dedicated to the person. Since I.Ya. Zolotarev also replaced T.I Selivanov as director of the Novocherkassk Gymnasium in 1838, we will take the liberty of taking a closer look on his characterization.

The inattention of historians to I.Ya. Zolotarev is all the more surprising that the latter was, apparently, the first Don Cossack who was a teacher at a higher educational institution. Here is what I.P. Artinskii wrote about Zolotarev's young years: "Zolotarev Ivan Yakovlevich, a son of a Voyskovoy Starshina of the Don Host, upon completing the course of the Novocherkassk Gymnasium in 1816 and Kharkov University in 1820, was awarded the title of candidate in 1822; at the university he was a sub-inspector, a teacher of rhetoric (1823) and poetry (1826), an assistant librarian, an adjunct professor of Russian language and literature (1829) and finally, a teacher of literary history" (Artinskii, 1907: 311). Thus, the personal pedagogical experience of I.Ya. Zolotarev was gained at a top-class university by the standards of the Russian Empire, and could not be compared with the experience of his prominent predecessors, A.G. Popov, who had never worked as a teacher, and A.G. Oridovsky, who taught only in secondary and primary educational institutions (and, by the way, had no higher education at all). At the same time, the future director of the Novocherkassk Gymnasium showed himself to be if not a brilliant, but quite a good teacher at a university level: the author of the monumental treatise "Historical experience of Kharkov University," D.I. Bagalei, even contrasted I.Ya. Zolotarev, "who gave lectures with at a fairly decent standard, although did not stand well with his students," with Professor of Russian Philology D.S. Borzenko, a much weaker lecturer, popular among students for his "jokes and witticisms" (Bagalei, 1904: 600). We also uncovered an interesting review of I.Ya. Zolotarev, made by one of his students, who preferred to conceal his identity behind the initials "I.B." This I.B. wrote about his lecturer that he "had a remarkable ability to recite Mogilevsky's Rhetoric; but the reciting was

monotonous and sent everyone to sleep" (Bagalei, 1904: 1111). We should add another detail to the portrait. According to D.I. Bagalei, in 1820, the Kharkov University and Kharkov society had more need in education propaganda than in scholarly activity proper, and several of its employees, including I.Ya. Zolotarev, "reduced almost all their scholarly efforts to purely literary and journalistic activities" (Bagalei, 1904: 731-732). We can see that despite his university-level teaching experience, I.Ya. Zolotarev was not a scholar; rather, it is more appropriate to consider him as an "ardent champion of education", like A.G. Oridovsky, who, by the way, also received education in Kharkov. Another common feature brings closer the candidate of sciences and the protoiereus – that is poetic attempts. I. Ya. Zolotarev, probably, was also the first Don poet who began to publish his poems in metropolitan editions. For example, two of his poems came out in Moskovskiy Telegraf in 1826. We should point out that, despite their low literary quality, the poems far exceeded the heavy classicism of A.G. Oridovsky and corresponded to the ideals of the then popular romanticism. For example, one of them, "Evening at the sea", was almost a parody as it replicated the poetry of the most renowned romantics:

"The shore has already set off... and here it runs away –
And in a moment it's gone in the gloomy distance...
So, why does sadness overwhelms your chest with longing,
And an unconscious tear fell from your eyes?" (I. Z-v', 1826: 60).

In D.I. Bagalei's view, many teachers of Russian language and literature, including I.Ya. Zolotarev, were invited to Kharkov University just for their "literary experiments" (Bagalei, 1904: 899). It is quite possible that the director-to-be of the Novocherkassk Gymnasium wrote his poems not out of inward inspiration, but because of career motives, trying to even up the lack of research works. In any case, after he returned to the Don region, he made no further attempts to show up in the poetic field.

As we can see, the few snippets of information about I.Ya. Zolotarev's work at Kharkov University depicts him as a serious teacher who thoroughly knew the material and even memorized it, and at the same time aspired to follow the spirit of the age. His superiors obviously valued him; I.Ya. Zolotarev had to leave the University only because the command of the Don Host tried to conscript him to active military service as Zolotarev was a Cossack by birth, and that the trustee of the Kharkov Educational District requested to replace the military service for him with the work of managing the Don educational institutions (Bagalei, 1904: 601). However, the new director of the Novocherkassk Gymnasium could neither impress with a bright personality that set apart A.G. Oridovsky, nor at least display any fundamental works comparable to "History of the Don Host" by A.G. Popov. As a result, any significant information about I.Ya. Zolotarev was only provided by I.P. Artinskii even among the Don authors of the early 20th century, who wrote a lot about the Don education. Giving an extraordinarily high appraisal of Zolotarev's activities as the head of the gymnasium, the local lore expert called "demand for discipline" towards himself and the teachers, happily combined with "kindness and care" about students, as one of the most crucial qualities of the director (Artinskii, 1907: 87).

As for I.Ya. Zolotarev's general pedagogical ideas, unfortunately, his detailed speeches have not survived to our days, except for those related to the Kharkov period. And only the reports sent by the Novocherkassk Gymnasium to the authorities and cited by I.P. Artinskii, give us an opportunity to identify the above-mentioned sympathy of its director for practice-oriented education. In this respect, the most characteristic example of the attitude can by rather a tough position taken by I.Ya. Zolotarev during the gymnasium reforms in the late 1840 and early 1850s. He successfully maneuvered not to introduce the Greek language into the curriculum of the Novocherkassk Gymnasium, on which the authorities of the Kharkov educational district insisted (Artinskii, 1907: 124, 127), and to postpone the start of teaching sciences until a special, seriously abridged curriculum was prepared (Artinskii, 1907: 132). I.Ya. Zolotarev justified his position in the following way: "Keeping in mind that the prime mission of the Don Host youth studying in a military gymnasium is military service after graduation, and that in the army civil service is so inseparable from the military one that servicemen engaged in special types of the service have military ranks and can freely move from one type of service to another, it was imperative to acknowledge that all students of the Cossack estate studying in the gymnasium, except for those who stated their willingness to enter the university and a small number of non-resident students, should necessarily have a course both on military sciences and on jurisprudence" (Artinskii, 1907:

126). However, in order to deliver the subjects in the "proper scope", it was necessary not only to refuse from introducing new subjects that eat up course hours, but also to cut some of the existing ones, "without weakening, however, the main and most relevant ones" (Artinskii, 1907: 126). Therefore, I. Ya. Zolotarev obviously gave preference to practical courses over subjects that did not bring clear benefits to the majority of gymnasium students in their future careers.

We think it is also indicative that it was under I.Ya. Zolotarev when the Novocherkassk Gymnasium launched its first special purpose department – the department of oriental languages. It was supposed to train translators for the Separate Caucasian Corps, and the initiative was handed over from above as the corresponding order was issued by Nicholas I himself in 1843 (RGIA. F. 1268. Op. 1. D. 525. L. 10). However, the Don authorities, represented by Ataman M.G. Vlasov, offered their full support to the undertaking (RGIA. F. 1268. Op. 1. D. 525. L. 11ob.), and, according to I.P. Artinskii, I.Ya. Zolotarev played a major role in facilitating the initiative (Artinskii, 1907: 134).

Finally, in the years when I.Ya. Zolotarev ran the gymnasium, the speeches delivered by teachers during official events, contained not a single argument about the advantage of enlightenment and about God, empty rhetorical flourish or generality. On the contrary, the speeches step by step transformed into real scientific and scholarly reports, and some of them have remained meaningful until now and serve as independent research objects for historians. For example, a speech by a history teacher, A.A. Leonov, "On textbooks to study the history of the Don Host", which was the first attempt to provide a historiographic review of the works on the history of the Don Cossacks, became a subject for a full-fledged research paper by A.A. Volvenko (Volvenko, 2019). A speech "On languages and dialects used in the Caucasus" made by T.N. Makarov who taught Tatar attracts certain attention among today's Dagestani historians and journalists (Mutsalkhanov, 2003). By the way, the changing topics and content of public speeches prepared by gymnasium teachers contributed to the growing interest among the public. For example, in October 1849, a set of lectures on agriculture was personally attended by Don Ataman M.G. Khomutov and many Don nobles (the set was not part of some official events or celebrations and attendance was voluntary) (Artinskii, 1907: 129).

Summarizing the above, I.Ya. Zolotarev's general pedagogical ideas corresponded to the views about practice-oriented education, which were conveyed by Don pedagogues since the 1830s. At the same time, he was not by any means, like A.G. Oridovsky, a public leader of those who mediated innovative ideas as the theoretical justification of practice-oriented education on the Don was formulated not by him, but by G. Rylsky and T.I. Selivanov in their public speeches in 1835 and 1836. Generally speaking, the new educational concept never had such a charismatic propagandist as A.G. Oridovsky who advocated the concept of the predominantly religious and moral significance of education, and therefore many details and nuances of the new concept were never clarified. I.Ya. Zolotarev was not so much the successor of A.G. Oridovsky, as that of A.G. Popov – he was a remarkable teacher practitioner, who was committed to the organization of the learning process in the Novocherkassk Gymnasium. The four most impactful measures in this area, implemented by I. Ya. Zolotarev, include the following:

1) Strict controls were introduced for the teachers to keep a range of records that correspond to modern class registers. A gymnasium inspector was instructed to "carefully monitor the following at all times: 1) that the overall monthly records for each past month are submitted in due time, i. e., not later than on the 6th or 7th day of the following month; 2) that in the overall records submitted by the inspector to the gymnasium council, the comments on the student attendance and marks, indicated by dates or scores, are completely aligned with the monthly records of the gymnasium teachers; 3) for the inspector to submit a special monthly report on the topics covered by the gymnasium teachers in the elementary and senior grades" (Artinskii, 1907: 88-89).

2) the pedagogical council of the gymnasium, which even had a Secretary, became fully functional (Artinskii, 1907: 96). Unfortunately, the minutes of the council meetings were lost by the beginning of the 20th century, but I.Ya. Zolotarev informed in one of his reports: "At the end of each month, the pedagogical council of all teachers in a body closely reviewed the successes in science, the diligence and behavior of the gymnasium students, and in line with this, immediate appropriate measures were taken" (Artinskii, 1907: 103).

3) I.Ya. Zolotarev managed to set up the process of skill enhancement for teachers, as it was understood at the time, more precisely, the process to "improve the activities of gymnasium mentors in the academic field", not only by motivating some teachers to take up translations and

write essays, but also by introducing awards for the best works (Artinskii, 1907: 101). Although the number of such works was no more than 4 per year, the range of topics demonstrated the growing interest of Novocherkassk teachers in the subjects they taught. For example, in 1842, the translation "On the art of tragedy" from F. Schiller, made by another teacher of Russian philology A.V. Kotlov was recognized as the best work. Interestingly, Kotlov graduated from Kharkov University only in 1838 (Artinskii, 1907: 101-102, 320). In 1843, the best work announced was "The presentation of the analytical theory of motion from the rotation of the Earth in space and the precession of equinoxes" by F.I. Anisimov, who graduated from Kharkov University and was appointed a mathematics teacher in the Novocherkassk Gymnasium in 1840 (Artinskii, 1907: 102, 327). The university graduation years of the winning teachers once again confirm our assumption that the new pedagogical ideas about practice-oriented education and the need for teachers to have the in-depth knowledge of their subjects were mostly supported by young teachers.

4) Finally, it was under I.Ya. Zolotarev that the Novocherkassk Gymnasium began to prepare curricula in active collaboration with the Kharkov educational district. I.P. Artinskii, with a reference to the gymnasium archives, dated the first known case of such relations to October 27, 1844, when the authorities turned their attention to the fact that "the grammar of the Latin language goes ahead of the grammar of the Russian language" in gymnasiums (Artinskii, 1907: 108). Appropriate corrective changes were made, and, in accordance with the new curricula, "Russian grammar preceded the foreign one, since the initial study of the former greatly simplified the study of the latter" (Artinskii, 1907: 108). In 1846, the Kharkov district adopted uniform programs for most subjects taught in gymnasiums, and it was the first time when this kind of order was actually put into action in the Novocherkassk Gymnasium (Artinskii, 1907: 110). However, the programs were extremely approximate and only in general terms determined what should be studied in which grade. For example, here is how the history program looked like: "3d grade – a short overview of world history; 4th grade – ancient history; 5th grade – medieval history; 6th grade – new history; 7th grade – Russian history" (Kholodnyi, 1886: 149). Moreover, even such a crude program was not developed for physics (Kholodnyi, 1886: 148-149).

All the measures were all the more important because the changes that began taking shape in the Novocherkassk Gymnasium after 1835 greatly boosted the number of students. To put that into perspective, we would like to provide the data of interest to us again in the form of a graph (the years, for which information has been lost, are omitted).

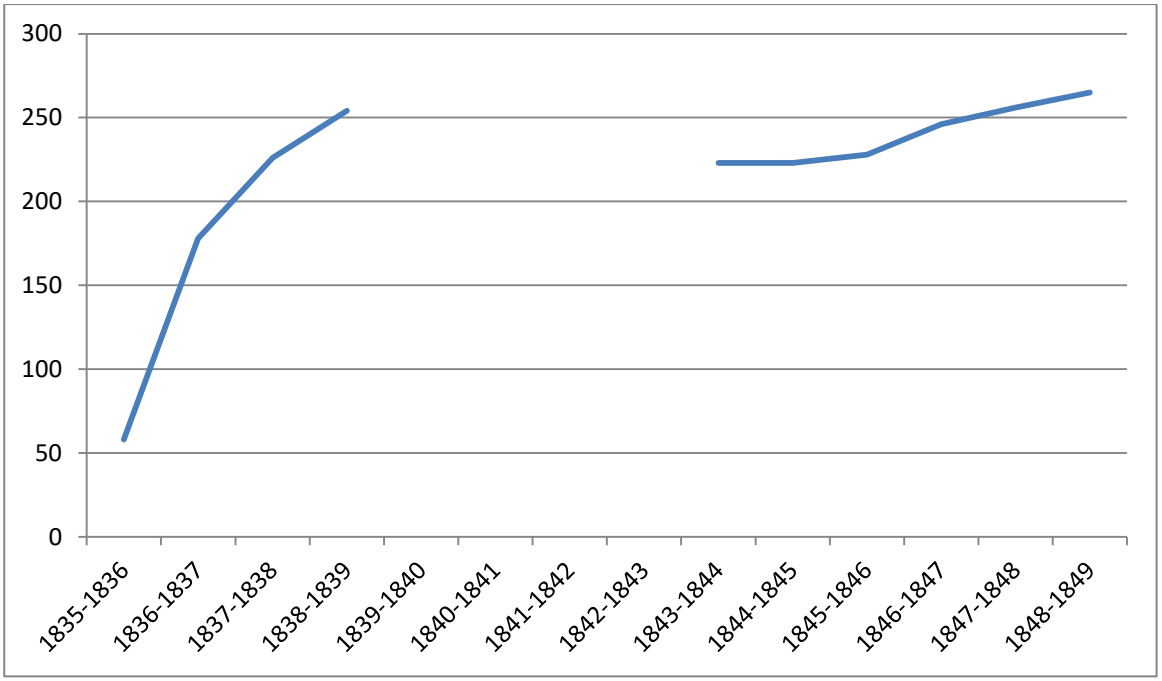


Fig. 2. Trends in the number of students in the Novocherkassk Gymnasium. 1836-1849. Source: Artinskii, 1907: 85-120

Number of pupils in the first grade reached 100 people in late 1830, which choked off any normal teaching process, and beginning in 1840 the two initial grades of the gymnasium were split into parallel streams (Artinskii, 1907: 97). This way, the number of groups increased from 4 to 9, and this completely impaired the old methods of educational process monitoring, developed by A.G. Popov, which implied the director's personal presence at lessons. The growing number of students left the Novocherkassk Gymnasium without options – it had to embrace the forms of methodological support of the educational process that had evolved by that time in other gymnasiums of the Kharkov educational district, despite the difficulties that the change inevitably entailed. However, the process was far from smooth. Perhaps I.Ya. Zolotarev's "demand for discipline" proved not to be that beneficial for the development of pedagogy on the Don, and even I.P. Artinskii admitted that in the 1840s, the teaching process in the gymnasium was not "in the least encouraging", and the files of the gymnasium archives for the period "testify more to hollow clerical work than to vigorous pedagogical activities" (Artinskii, 1907: 114). And yet, even these excesses were more useful than the complete chaos in the educational process that had been predominant, with rare exceptions, in the Novocherkassk Gymnasium since its foundation until the appointment of I.Ya. Zolotarev as its director.

We can state that, although historiography rightly associates the establishment of the Novocherkassk Gymnasium with A.G. Popov, it was I. Ya. Zolotarev who managed to transform this gymnasium into an educational institution that might not be first-rate by the standards of the Russian Empire, but corresponded to the requirements of the 19th century. Teachers were at last made fully accountable for teaching specific disciplines according to the approved programs, and the programs were devised based on the needs of the Don and the Caucasus. The normal progression of the educational process was ensured not only by the director, but also by the pedagogical council that reviewed monthly report cards. But I.Ya. Zolotarev's main achievement was, perhaps, his success in organizing research and social activity of at least some of the teachers. We wrote at the beginning of our first paper that many Don scholars, writers and public figures of the 19th century taught at the Novocherkassk Gymnasium. The tradition was started by A.G. Popov and A.G. Oridovsky, but they already were prominent personalities by the time they joined the gymnasium (as was, by the way, I.Ya. Zolotarev himself). However, later, from 1820 to 1830, no people that had any significant role in the history of the Don Cossacks, except for I.Ya. Zolotarev, remained in the gymnasium. But in 1840, the situation improved when some teachers, who started as young specialists unknown to anyone, fulfilled themselves and who forever went down into history, often through the most unexpected accomplishments.

In this regard, a particularly indicative figure is the mathematics teacher already mentioned above, F.I. Anisimov, the author of "The presentation of the analytical theory of motion from the rotation of the Earth in space and the precession of equinoxes". The point is that this is the F.I. Anisimov, who wrote the song "Vskolykhnulsya, vzvolnovalsya pravoslavnyy Tikhiy Don" (It has shaken, has stirred the Orthodox Quiet Don), which has been the anthem of the Rostov Region since that time (Babaitsev, 2012: 131). The very fact that a Novocherkassk teacher wrote the anthem of all Don Cossacks makes him a significant historical figure. In addition, considering that he was one of the first Don Cossacks who studied mathematics as a science, the important role of F.I. Anisimov grows even further. Alas, we know very little about him as we do about many other teachers in the Novocherkassk Gymnasium of the first half of the 19th century. Perhaps, the only description of his personality given by the trustee of the Kharkov educational district is cited by I.P. Artinskii: "Demonstrates particular talents and love for mathematical sciences where he has already acquired very great knowledge and shows a considerable promise that over time he will become a useful scientist in this area" (Artinskii, 1907: 98).

We cannot omit to mention T.N. Makarov here, an iconic figure for the Kumyk people, who compiled the "first grammar of the Kumyk language" (Abdullabekova, 2018: 24). The appointment of the man to the Novocherkassk Gymnasium illustrates what care was taken to pick teachers for the department of oriental languages. His candidacy was discussed in St. Petersburg, where the teacher of the Tatar language finally was characterized as follows: "He is a graduate of the Astrakhan Gymnasium, and, being a child of a soldier, joined the St. Petersburg Battalion of Army Cantonists in 1842 as a private; as for his behavior and knowledge of sciences, his closest superiors give him excellent recommendations; in addition to teaching Russian in the clerks' class, Makarov sings in a choir and is preparing to become a teacher of history and geography for the battalion's

artillery classes" (RGIA. F. 1268. Op. 1. D. 525. Л. 12ob.). While the process of organizing the department of oriental languages in the Novocherkassk Gymnasium proceeded with some delays and protractions, T.N. Makarov spent several years in the Caucasus "to familiarize himself with the position of a translator and interpreter" (Artinskii, 1907: 135). It was at this time that T.N. Makarov completed and published his "Tatar grammar of the Caucasian dialect", "the first grammar of the Kumyk language". With the work, he, apparently, pursued pedagogical goals by compiling a textbook for his future lessons. At least he explained it like this in the preface to his book: "I tried to compile some kind of guidebook to study the vernacular" (Abdullabekova, 2018: 26).

In fact, it was the development of the oriental languages department in the Novocherkassk Gymnasium that first inspired a number of gymnasium teachers to create proper textbooks. In addition to T.N. Makarov, textbooks on Caucasian languages were written by M. Khandiev (Avar) (Abdulaeva, 2009: 8-9) and A. Vizirov (Azerbaijani) (Vizirov, 1861). Interestingly, there were two men with the name M. Khandiev in the Novocherkassk Gymnasium, who compiled textbooks on the Avar language. They were Magomet Khandiev from the village of Kafir and Magoma Khandiev from the village of Tida, who are confused on some popular Internet resources (Artinskii, 1907: 349-350). It was the book by A. Vizirov that became the first textbook that was written by a practicing teacher of the Novocherkassk Gymnasium and reached the stage of actual publication. However, Novocherkassk teachers appeared to have even more ambitious and long-term plans. In any case, as early as in 1851, T.N. Makarov, bolstered by I. Ya. Zolotarev, put forward a proposal to the authorities to print a textbook on the language of Caucasian Tatars, but in the end the book was returned for revision (GARO. F. 358. Op. 1. D. 157. L. 2-31).

We can conclude that when I.Ya. Zolotarev managed the Novocherkassk Gymnasium, the teaching staff qualification also improved considerably. Random people, even with excellent, metropolitan or foreign education, but without passion for their subject, were replaced by professional teachers, mostly graduates of Kharkov University. Some of them even carried out research projects, however primitive and amateurish forms they had, and we can point out that there were authors of first grammars for several Caucasian ethnic groups among the staff of the oriental languages department. Unfortunately, as we have already noted above, almost no accounts and descriptions of teachers exist today made by those who studied in the Novocherkassk Gymnasium in 1830-1850. As for the gymnasium archive, already in the early 19th century, the materials there contained too little information to clearly identify the formats of the classes conducted by the teachers.

Despite the above, we can confidently assert that the actual teaching methodology remained rather weak and ineffective in the Novocherkassk Gymnasium even under I.Ya. Zolotarev. A narration reached out time retelling the reasoning of one of the teachers in this period, A.A. Leonov (he taught Russian philology and history), on how to organize lessons on the Russian language, and the narration is very eloquent: "Leonov failed to specify exactly which excerpts and articles, and in what consecutive order he suggests to be read in the classroom, while a strict selection of articles is prerequisite for the proper development of students. In his studies of the Russian grammar, Leonov focused on the formal side of the subject: he, as he put it, did not care "about the content" of the article he had read, as long as the article was correct "in expression", since it was only needed on his lessons to "infer grammar rules based on it" (Artinskii, 1907: 193). Moreover, at one of the pedagogical council's meetings in 1860, A.A. Leonov debated with the majority of teachers, arguing that already primary school pupils should study linguistic theory, despite the fact that the children in these grades were too young to comprehend the subject, and experience actually showed that the method had little practical value (Artinskii, 1907: 194). We should note that A.A. Leonov was one of the teachers who were the honor of the gymnasium, like A.G. Oridovsky and I. Ya. Zolotarev, he was one of the first Don poets, and his first collection of poem received positive reviews of V.G. Belinskii himself (Belinskii, 1953: 231-234), and at a mature age, he published a series of articles on local history and lore, becoming one of the major Don historians of his time (Volvenko, 2015: 196-197). It seems that other teachers did even worse. At least as early as in the 1860s, the meetings of the Novocherkassk Gymnasium's pedagogical council raised the issue of formal and inconsistent teaching of basic subjects (Artinskii, 1907: 191-194). The fact that I.P. Artinskii, while doing his research in the gymnasium archive, could not find any information about methodological, rather than organizational or disciplinary meetings of the pedagogical council until the 1860s, also indirectly indicates that during I.Ya. Zolotarev's

directorship, pedagogical inefficiency of lessons was of little concern to teachers. And the situation combined with a growing formality of requirements for students, led to a paradoxical result – after the 1835-1836 academic year, while the number of students in the gymnasium dramatically increased, the number of graduates who finished the academic course dropped. We would like to provide the data of interest to us again using a graph. It is appropriate to remind here that pre-revolutionary gymnasiums conducted promotion exams to transfer students to upper grades, and final examinations were extremely difficult, which explains why most students did not finish the full gymnasium curriculum. We will return to this point later when we discuss the proportion of graduates of the military and legal classes.

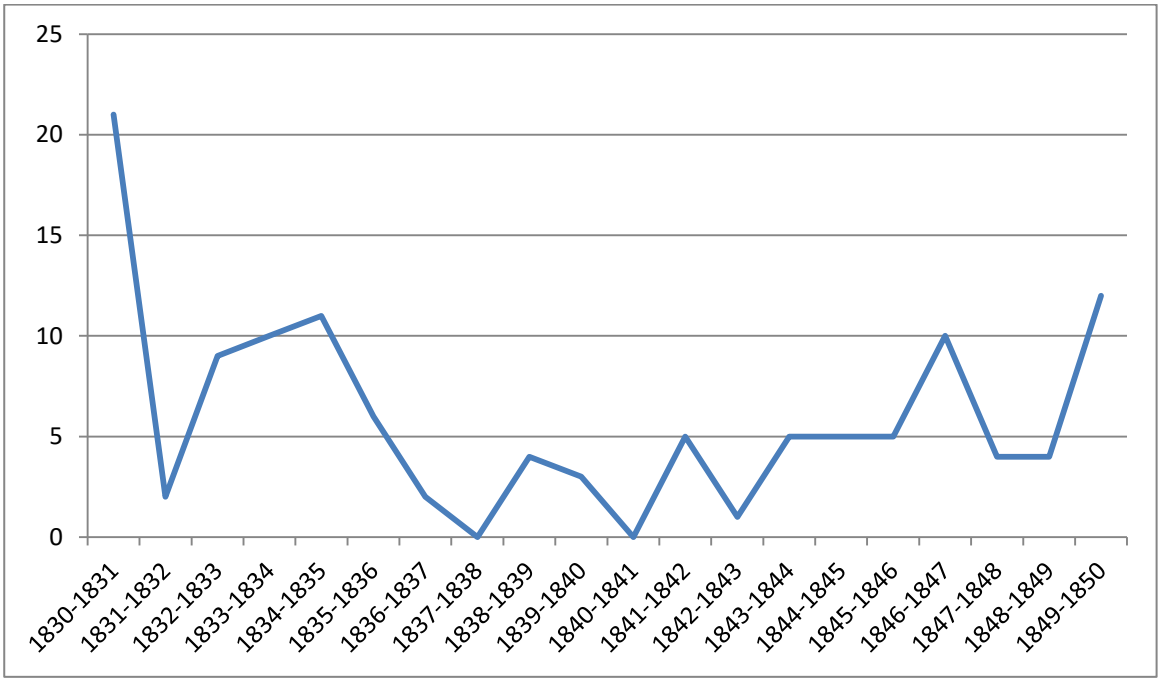


Fig. 3. Trends in number of Novocherkassk Gymnasium graduates who received a certificate of successful completion of the full course. 1830-1850.
Source: Artinskii, 1907: 423-424

So, it turns out that the number of students grew 2 or 3 times, while the number of graduates fell 2 or 3 times in the Novocherkassk Gymnasium in the 1830-1840s. I.Ya. Zolotarev also appeared to understand the problem of inefficient teaching practices that were used because he wrote, for example, about the lessons in modern languages: "With all the diligence of instructors, teaching French and German was unsatisfactory and even poor not only in the lower grades, but even in the upper grades of the gymnasium" (Artinskii, 1907: 115). However, the director apparently did not know how to substantially remedy the situation.

In addition, as time passed, it became increasingly clear, that the main pedagogical goal, which had been announced by the authorities of the Novocherkassk Gymnasium since 1830, remained out of the institution's reach. Despite all bold statements by T.I. Selivanov and I.Ya. Zolotarev, "a better upbringing and education for their military and civilian journey" and the preparation of gymnasium students for their work in the Don Host went amiss. Perhaps the most fitting remark on the point was made by N.I. Krasnov, another outstanding Don Cossack who was a teacher at the gymnasium and the author of the first published historical and statistical description of the Land of the Don Host. It might seem that with him the gymnasium received a superior teacher of military sciences – by the time of his appointment, he graduated from the Academy of the General Staff and distinguished himself in the Crimean War (Korolev, 1991: 234-235). However, in practice, N.I. Krasnov's lessons were attended by very few gymnasium students, despite the fact that I.Ya. Zolotarev, as we could see above, expressed a desire "that all students of the Cossack estate studying in the gymnasium, <...> should necessarily have a course both on

military sciences and on jurisprudence"/N.I. Krasnov gave the following explanation to the situation: "Students, who were particularly diligent and enthusiastic in attending military sciences and jurisprudence, find themselves getting behind on other subjects, as a result there are no more than one graduate in two or even three years who exercises their right to join the military service with a rank; the rest begin as Cossacks and sergeants and are promoted to an officer's rank after twelve years of service. This inequality in obtaining benefits and difficulties with entering the university dampen the aspiration to learn more about the military science, and the number of attendees at the lectures has been decreasing from year to year" (Krasnov, 1863: 399). In summary, with most subjects being taught in a weak and formal manner in the Novocherkassk Gymnasium, those of its students, who were willing to receive a practice-oriented education, found themselves in the worst position – they studied military sciences and jurisprudence in addition to general subjects, and often flunked exams in the latter. In contrast to the high-flown speeches of the gymnasium authorities, the gymnasium's actual performance in training officers and officials can hardly be called anything other than a failure – for example, in 1849-1858, only 27 students attended a jurisprudence course, 8 of them successfully competed the gymnasium curriculum and received certificates, and only 2 chose to continue their career in the army (Artinskii, 1907: 172). A paradoxical situation arose as the Novocherkassk Gymnasium under I.Ya. Zolotarev became a true educational, cultural and scientific center for the Land of the Don Host, it was unable to fulfil its primary officially declared mission – to deliver quality personnel training for this army.

And it remains for us to state that a period of booming progress at the end of 1830–1840 was followed by a new serious crisis for the Novocherkassk Gymnasium, and it is remarkable that both the progress and the crisis were the result of changes in the pedagogical views of the gymnasium teaching staff. By rejecting the idea of the beneficial nature of any education and the glorification of abstract "sciences" in favor of in-depth study of specific, practice-oriented disciplines using common methods for the Kharkov educational district, the institution managed to improve the qualification of the pedagogical personnel, attract a lot more students and, eventually, in the fourth decade of its existence, to set up a normal educational process. However, when all this was achieved, it turned out that the right process took something more than appointing professional specialists in their relative fields as teachers and outlining to them what they should teach gymnasium students. It was also necessary to somehow ensure the communication of knowledge from a teacher to students and identify productive formats of course programs and individual lessons. But it appears that I.Ya. Zolotarev and the teachers invited by him in 1830-1840 did not understand this, although they had a certain feeling of dissatisfaction over the results of their work. We showed that course programs were periodically revised, the gymnasium's management made efforts to retain practice-oriented courses in their full scope, but those measures only yielded insignificant real-life results, and, according to I.P. Artinskii, "hollow clerical work" prevailed over "vigorous pedagogical activities". After all, by 1850, the Novocherkassk Gymnasium lapsed in the same situation in which it existed in 1810 – the pedagogical views of most teachers were a barrier to its evolution, and further development required another change of the generation of teachers.

4. Conclusion

The first fundamental shift in the pedagogical views of the teachers in the Novocherkassk Gymnasium took place in the 1830s. It is hard to pinpoint its reasons because too little information is available now on the subject. We can suggest that the agents of change were relatively young teachers, mostly graduates of Kharkov University, who had knowledge of modern trends in education and understood that the enlightenment concept of the benefits of any "sciences", brought to the Don as early as by A.G. Popov and A.G. Oridovsky, was badly behind the times. The pivotal point was most clearly illustrated by the public speeches of the gymnasium teachers. Until 1835, the speeches were devoted to very abstract topics, and, regardless of the details, their dominant theme was the praise of education as a road to man's moral and religious self-improvement. After G. Rylsky's speech on the "key applications" of pure mathematics in contemporary society, delivered in 1835, we could see a dramatic U-turn in the situation when gymnasium teachers began to make presentations on research and practical topics related to their subjects, the rhetorical flourish was replaced with specific information, facts and advice to the audience, and some of the speeches (above of all on the history of Don Cossacks and on Caucasian languages) are of certain interest even today.

At the core of innovative pedagogical views conveyed by Novocherkassk teachers was the idea that gymnasium students needed a practice-oriented education. The teachers regarded the Novocherkassk Gymnasium as an educational institution specifically tailored to the needs of the Don Host, as a truly military school rather than an ordinary gymnasium. With this thought in mind, the gymnasium management introduced special courses in military sciences and jurisprudence for students who did not plan to enter the university. The gymnasium even went as far as opening a department of oriental languages, the first highly specialized educational institution on the Don. Perhaps the teachers also tried to link basic subjects with real-life needs. At least the same G. Rylsky emphasized the importance of pure mathematics for land surveyors and traders. However, the new generation of teachers in the Novocherkassk Gymnasium had no major theoretician pedagogue comparable to A.G. Oridovsky, and this can also be considered indicative of the changes that took place. For this reason, the theoretical pedagogical views of the teachers who worked in the Novocherkassk Gymnasium in 1830–1850, were never formulated with detailed precision.

The Novocherkassk teachers were now inspired not by a theoretician, but by a practitioner, the new director of the gymnasium, I.Ya. Zolotarev, the first Don Cossack who taught at a higher educational institution. It was I.Ya. Zolotarev who finally succeeded in organizing a normal educational process in the Novocherkassk Gymnasium, Indeed, subjects were now taught according to curricula unified for the Kharkov educational district; a version of records was introduced similar to modern class registers; finally, the pedagogical council of the gymnasium became a genuinely operative body. Of course, I. Ya. Zolotarev was not an innovator if considered on a national scale, and gymnasiums in large cities put all these measures into practice long ago. However, such a sharp focus on the all-Russian educational practices became a major innovation for the Land of the Don Host of the mid-19th century, which gave he local gymnasium a considerable momentum for development after a period of inertia that reigned since the death of A.G. Oridovsky. In addition, I. Ya. Zolotarev managed to find a number of prominent figures to teach at the gymnasium, such as F.I. Anisimov, the author of the anthem of the Don Cossacks, A.A. Leonov, one of the major Don amateur historians of the mid-19th century, T.N. Makarov and M. Khandiev, authors of the grammar basics textbooks on the Caucasian languages. Moreover, the merit of the achievements made by the people can be largely attributed to I.Ya. Zolotarev – through his efforts teachers' research and social work received encouragement, including financial rewards, from the gymnasium management. Therefore, while earlier any extracurricular achievements of Novocherkassk teachers were due to chance (in fact, only A.G. Popov and A.G. Oridovsky had such achievements, and the gymnasium did not play any role in them), from 1840 accomplishments became a norm. The Novocherkassk Gymnasium restored its status as the leading cultural and scientific center of the Don Host to preserve it until the end of the century.

However, the weakness in the pedagogical views of I.Ya. Zolotarev and his subordinates was, oddly enough, lack of attention to the actual instructional side of teaching. Although any random people already left the teaching staff of the Novocherkassk Gymnasium, mere willingness to give knowledge to the younger generation was not sufficient. The Don teachers did not yet develop truly efficient practices of working with students. The course programs were very general and gave the teachers a free hand in selecting instruction formats; on the other hand, most teachers adopted a formal approach to the educational process organization and did not analyze the efficiency of their activities. The most striking example of the attitude are the methods used by an experienced and respected teacher, A.A. Leonov, who tried for many years to explain the linguistic theory to children in the lower grades, not taking into account that the majority of pupils were simply to young to understand it. The pedagogical council seemed not to discuss at all teaching methodology at its meetings in 1830-1850.

By the 1850s, it became clear that the teachers of the Novocherkassk Gymnasium faced a new contradiction between theory and practice, and addressing the issue was crucial for any further progress. Several decades earlier, the incompetence of the majority of gymnasium teachers stood in stark contrast to their ideas about the absolute benefits of any education. Now the prevailing ideas of the much-needed practice-oriented education provided an equally stark contrast to the fact that most students, who chose practical courses in military sciences and jurisprudence, could not even complete the gymnasium curriculum because of poor marks in basic subjects. Alas, I. Ya. Zolotarev and his supporters, it seems, did not even think to connect this fact with the problems in teaching

methods used for these subjects. Their pedagogical ideas, which created a positive impact on the development of Don education, exhausted their potential, just as earlier did the ideas of A.G. Popov and A.G. Oridovsky.

References

Abdulaeva, 2009 – *Abdulaeva, M.Sh.* (2009). Dagestanskaya russkoyazychnaya intelligentsiya v XIX v.: na puti k mezhkul'turnym kommunikatsiyam [Dagestan russian-speaking intelligentsia in the 19th century: on the way to intercultural communications]. *Izvestiya Rossiiskogo gosudarstvennogo pedagogicheskogo universiteta im. A.I. Gertsena*. 106: 7-14. [in Russian]

Abdullabekova, 2018 – *Abdullabekova, U.B.* (2018). «Tatarskaya grammatika kavkazskogo narechiya» – pervaya kirillicheskaya grammatika kumykskogo yazyka ["Tatar grammar of the Caucasian dialect" – the first Cyrillic grammar of the kumyk language]. *Vestnik Instituta yazyka, literatury i iskusstva im. G. Tsadasy*. 16: 24-28. [in Russian]

Artinskii, 1907 – *Artinskii, I.P.* (1907). Ocherk istorii Novocherkasskoi voiskovoi gimnazii [Essay on the history of the Novocherkassk military gymnasium]. Novocherkassk. 469 p. [in Russian]

Babaitsev, 2012 – *Babaitsev, A.V.* (2012). Simvolika Rostovskoi oblasti: mezhdu traditsiei i sovremennost'yu [Symbols of the Rostov Region: between tradition and modernity]. *Nauchnaya mysl' Kavkaza*. 2: 127-134. [in Russian]

Bagalei, 1904 – *Bagalei, D.I.* (1904). Opyt istorii Khar'kovskogo universiteta (po neizdannym materialam) [Experience of the history of Kharkiv University (based on unpublished materials)]. T. II. Khar'kov. 1136 p. [in Russian]

Belinskii, 1953 – *Belinskii, V.G.* (1953). Stikhotvoreniya Alekseya Leonova [Poems by Alexei Leonov]. Polnoe sobranie sochinenii. T III. M. Pp. 231-234. [in Russian]

Cherkasov et al., 2019a – *Cherkasov, A.A., Bratanovskii, S.N., Koroleva, L.A., Zimovets, L.G.* (2019). Development of school education in the Vologda governorate (1725-1917). Part 1. *European Journal of Contemporary Education*. 8(1): 208-214.

Cherkasov et al., 2019b – *Cherkasov, A.A., Bratanovskii, S.N., Koroleva, L.A., Zimovets, L.G.* (2019). Development of school education in the Vologda governorate (1725-1917). Part 2. *European Journal of Contemporary Education*. 8(2): 418-424.

Cherkasov et al., 2019c – *Cherkasov, A.A., Bratanovskii, S.N., Koroleva, L.A., Zimovets, L.G.* (2019). Development of school education in the Vologda governorate (1725-1917). Part 3. *European Journal of Contemporary Education*. 8(3): 627-637.

Cherkasov et al., 2019d – *Cherkasov, A.A., Bratanovskii, S.N., Koroleva, L.A., Zimovets, L.G.* (2019). Development of school education in the Vologda governorate (1725-1917). Part 4. *European Journal of Contemporary Education*. 8(4): 973-983.

Filonov, 1859 – *Filonov, A.G.* (1859). Ocherki Dona [Essays of the Don]. SPB. 195 p. [in Russian]

GARO – Gosudarstvennyi arkhiv Rostovskoi oblasti [State archive of the Rostov region]. [in Russian]

I. Z-v', 1826 – I. Z-v'. (1826). Vecher na more [Evening at the sea]. *Moskovskii telegraf*. Ch. 10. Pp. 60-61. [in Russian]

Kholodnyi, 1886 – *Kholodnyi, G.M.* (1886). Istoricheskaya zapiska o Tambovskoi gimnazii. 1786–1886 [Historical note about the Tambov gymnasium]. Tambov. 328 p. [in Russian]

Korolev, 1991 – *Korolev, V.N.* (1991). Starye Veshki. Povestvovanie o kazakakh [Old Milestones. The story of the Cossacks]. Rostov-na-Donu. 464 p. [in Russian]

Krasnov, 1863 – *Krasnov, N.I.* (1863). Materialy dlya geografii i statistiki Rossii, sobrannye ofitserami General'nogo shtaba [Materials for geography and statistics of Russia, collected by officers of the General Staff]. Zemlya voiska Donskogo. SPb. 596 p. [in Russian]

L.B., 1906 – L.B. Aleksei Grigor'evich Popov, pervyi direktor voiskovoi gimnazii [Alexey Grigoryevich Popov, the first director of the military gymnasium]. *Sbornik oblastnogo Voiska Donskogo statisticheskogo komiteta*. Vyp. 6. Novocherkassk, 1906. Pp. 49-59. [in Russian]

Molchanova et al., 2019a – *Molchanova, V.S., Balanyuk, L.L., Vidishcheva, E.V., Potapova, I.I.* (2019). The Development of Primary Education on the Cossack Territories in 1803–1917 years (on the Example of the Kuban Region). Part 1. *Bylye Gody*. 53(3): 1049-1058.

Molchanova et al., 2019b – *Molchanova, V.S., Balanyuk, L.L., Vidishcheva, E.V., Potapova, I.I.* (2019). The Development of Primary Education on the Cossack Territories in 1803–1917 years (on the Example of the Kuban Region). Part 2. *Bylye Gody*. Vol. 54. Is. 4: 1524-1536.

Molchanova et al., 2020 – *Molchanova, V.S., Balanyuk, L.L., Vidishcheva, E.V., Potapova, I.I.* (2020). The Development of Primary Education on the Cossack Territories in 1803–1917 years (on the Example of the Kuban Region). Part 3. *Bylye Gody*. Vol. 55. Is. 1: 88-104.

Mutsalkhanov, 2003 – *Mutsalkhanov, M.S.* (2003). Grammatika Timofeya Makarova: poiski, nakhodki, issledovaniya [Grammar of Timofei Makarov: searches, finds, studies]. *Vesti Kumykskogo nauchno-kul'turnogo obshchestva*. 8-10. [Electronic resource]. URL: http://kumukia.ru/?id=604 [in Russian]

Natolochnaya et al., 2019a – *Natolochnaya, O.V., Bulgarova, B.A., Voropaeva, Y.A., Volkov, A.N.* (2019). The History of the Public Education System in Vilna Governorate (the Second Half of the 19th and the Early 20th Centuries). Part 1. *European Journal of Contemporary Education*. 8(3): 655-664.

Natolochnaya et al., 2019b – *Natolochnaya, O.V., Bulgarova, B.A., Voropaeva, Y.A., Volkov, A.N.* (2019). The History of the Public Education System in Vilna Governorate (the Second Half of the 19th and the Early 20th Centuries). Part 2. *European Journal of Contemporary Education*. 8(4): 964-972.

Rechi..., b. g. – Rechi, proiznesennye v torzhestvennykh sobraniyakh Novocherkasskoi gimnazii s 1832 goda [Speech delivered in ceremonial collections of the Novocherkassk gymnasium since 1832]. B. m., b. g. 127 p. [in Russian]

RGIA – Rossiiskii gosudarstvennyi istoricheskii arkhiv. [in Russian]

Shevchenko et al., 2016 – *Shevchenko, N.A., Vidishcheva, E.V., Emelyanova, O.V.* (2016). The establishment of the system of public education in the Caucasus (1802-1917 years): The characteristic features. *Bylye Gody*. 40(2): 363-372.

Sukhorukov, 1891 – *Sukhorukov, V.D.* (1891). Statisticheskoe opisanie Zemli Donskikh kazakov, sostavlennoe v 1822–1832 godakh [Statistical description of the Don Cossacks Land, compiled in 1822–1832]. Novocherkassk. 302 p. [in Russian]

Vizirov, 1861 – *Vizirov, A.* (1861). Uchebnik tatarsko-aderbeidzhanskogo narechiya, sostavlennyi uchitelem Otdeleniya vostochnykh yazykov pri Novocherkasskoi gimnazii mirzoyu Abu-l'-Khasan-Bekom Vizirovym [Textbook of the tatar-adebeydzhan dialect, compiled by the teacher of the Department of oriental languages at the Novocherkassk Gymnasium, Mirza Abu-al-Hasan-Bek Vizirov]. SPb. 207 p. [in Russian]

Volvenko, 2015 – *Volvenko, A.A.* (2015). Kazakomanstvo. Don case (the 1860th). Part III. *Russkaya Starina*. Vol.(15). Is. 3. Pp. 194-207.

Volvenko, 2019 – *Volvenko, A.A.* (2019). O chem govoril uchitel' russkogo yazyka voiskovoi starshina A. Leonov «na torzhestvennom akte» Novocherkasskoi gimnazii 12 avgusta 1854 goda? [What did the Russian language teacher military foreman A. Leonov speak about “at the solemn act” of the Novocherkassk gymnasium on August 12, 1854?]. *Novoe proshloe*. 2: 134-167. [in Russian]

Vospominaniya..., 1873 – Vospominaniya starogo dontsa. Iz posmertnykh zapisok general-leitenanta Krasnova [Memoirs of an old don. From the posthumous notes of lieutenant general Krasnov]. *Voennyi sbornik*. 1873. 12: 363-380. [in Russian]