European Journal of Contemporary Education

Has been issued since 2012.
E-ISSN 2305-6746
2018, 7(3). Issued 4 times a year
MIAR ICDS 2017 – 9,301

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

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Website: http://www.aphr.ru
E-mail: ejce@inbox.ru

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

Release date 15.09.18.
Format 21 × 29,7/4.

Headset Georgia.

Order № 224.

European Journal of Contemporary Education

2018

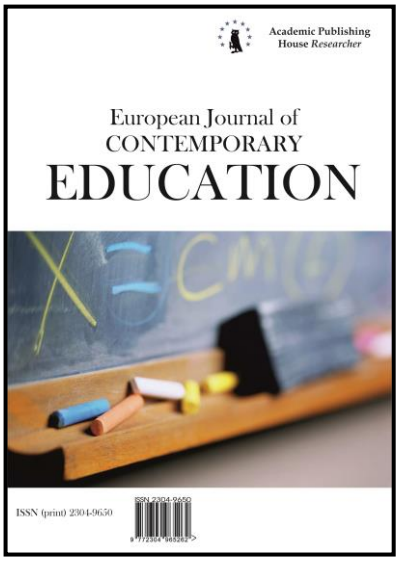
Is. 3

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
2018, 7(3): 448-457
DOI: 10.13187/ejced.2018.3.448
www.ejournal1.com



The Problems of Contemporary Education

Competitive Learning Using a Three-Parameter Logistic Model

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Abstract

The purpose of this paper is to analyze the test applied at the eighth Statistics II tournament to students from the University Center for Economic and Administrative Sciences of the University of Guadalajara, for the purpose of determining whether it promotes competitive learning among students. To achieve this, Item Response Theory (IRT) is used, specifically in the form of a three-parameter logistic model. The findings show that approximately 20 % of the participating students performed at a level ranging from outstanding to satisfactory, while the rest had a performance that fell between regular and poor. The findings also indicate that participating students were motivated by academic competition and the opportunity to improve their skills in the area of statistics. Moreover, we concluded that the tournament's assessment instruments need to be substantially improved in terms of design and the content of the items.

Keywords: competitive learning, Item response theory, Logic model.

1. Introduction

Meaningful learning techniques are intended to teach learners to solve problems or master certain topics and areas of knowledge (Hierro et al., 2014). Academic competitions, for their part, encourage better performance among students (Regueras et al., 2009). In this sense, Cantador & Conde (2010) and Lawrence (2004) conclude that skills and knowledge tournaments stimulate healthy and fair competition among students and generate higher implicit motivation in them.

Since the tournament constitutes an academic challenge, students require what is known as competitive learning (Johnson, Johnson, 2002; Kim, Sonnenwald, 2002; Owens, Straton, 1980),

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which essentially consists of outperforming the other tournament competitors academically by obtaining a better result on the test. In this sense, competitions revolving around academic abilities and knowledge significantly improve participants' performance, through intellectual challenges and active experience, thus promoting confidence and motivation in the students who take part in the event, even those who are seen as weaker (Carpio Cañada et al., 2015; Fasli, Michalakopoulos, 2015; Lawrence, 2004; Verhoeff, 1997).

The Department of Quantitative Methods (DQM) of the University of Guadalajara (UdG) organizes an annual Statistics II Tournament (ST_II) for the purpose of promoting academic competition and, implicitly, competitive learning in the area of statistics among interested students enrolled at the University Center for Economic and Administrative Sciences (CUCEA). The event consists of two rounds, and the model examined in this paper refers to the test used in the first round.

Among the extensive literature that considers the application of tests of abilities and knowledge in university settings, the so-called Item Response Theory (IRT) can be found. This theory, among other things, serves to analyze curricular content, adequate item design, the recognition of teaching-learning problems and the identification of students with low or high academic ability (Awopeju, Afolabi, 2016; Balmori et al., 2011; DiBattista, Kurzawa, 2011; Ingale et al., 2017; Mitra et al., 2009; Rao et al., 2016; Romero et al., 2015).

In our opinion, there is no literature that analyzes multiple-choice tests used in academic competitions at the university level. For this reason the present study is relevant, as it examines this evaluation instrument using IRT theory to identify the type of students who participate in ST_II and determine whether the event fulfills the objectives proposed by the DQM, which include the promotion of competitive learning, the application of problem-solving skills and the general development of students' statistical abilities.

The paper is structured as follows: section 2 explains the methodology and data used; section 3 shows the results; finally, section 4 presents conclusions.

2. Data and methodology

Data

The Statistics II course is taught at CUCEA in eleven of the thirteen undergraduate programs offered at that particular university campus. The DQM has organized ST_II every year since 2009, with the intention of enhancing the statistical abilities of the university's graduates by having them solve practical problems that require them to apply what they have learned during the course, while promoting academic competition among the students (DMC, 2017).

Statistics courses are taught by a group of specialized professors that make up the Academy of Statistics, which belongs to the DQM. A committee of professors from this Academy is in charge of organizing the event, both the logistics and the academic aspects, including content selection and the design and development of test questions. The 2017 edition of ST_II consisted of two rounds; the first round was open to interested students who were taking the Statistics II course. The test applied in this first round consisted of 20 multiple-choice questions. The test is not included in this paper for reasons of confidentiality, as requested by the DQM.

The test corresponding to the first round was taken by 99 students of an eligible population of 1,666, which represents 5.94 % of the total. The finalists of this first round were the 20 students obtaining the highest score on the multiple-choice test. These students were chosen for the second round, and the students with the highest scores in this second round were awarded prizes such as scholarships, university books, graphing calculators and financial calculators sponsored by different organizations.

The test examined in this paper was the one applied in the first round of the ST_II; considering the size of the population, the sample size is quite acceptable. As mentioned above, the test consists of 20 multiple-choice questions, each with five options: one right answer and four distractors. The contents included sampling theory, parameter estimation, and hypothesis testing for large and small samples. For more information about this test, go to http://metodos.cucea.udg.mx/estadistica.php.

Multiple-choice tests, like all evaluation instruments, have advantages and disadvantages. The advantages include the evaluation of critical comprehension and knowledge and the memorization of simple concepts; they can assess whether algorithms and procedures are

performed accurately in solving problems or in ordinary calculations; they reduce the probability of guessing right (probability declines as the number of distractors rises). When it comes to disadvantages, syntax errors are the most frequent, as they generate confusion and misinterpretation both in the formulation of questions and in the answers and distractors (Best, Kahn, 2006; DiBattista, Kurzawa, 2011; Miller et al., 2009; Zamri Khairani, Shamsuddin, 2016).

Methodology

In educational research, one of the fundamental purposes is to quantify variables that will estimate the performance achieved in the teaching-learning process. This variable is known as a latent or treatment variable, and it quantifies a non-observable underlying characteristic. In our case, it will measure the ability level of ST_II contest participants in the Statistics 2 course. To analyze this variable, IRT (Baker, Kim, 2017) is used to analyze the magnitude and characteristic values of this latent variable.

Different papers mention the advantages of using IRT. These advantages include the following: greater emphasis can be placed on the distinctive characteristics of the questions rather than on the essential properties of the tests; tests can be modeled in a non-linear way, with one, two or even three parameters, in order to establish with greater certainty which model lends itself best to the distribution of the available data; the scale of the latent variable (ability level) is in the (-∞,∞) interval, although it can easily be transformed into another scale; it has the quality of being invariant; and finally, the values of the parameters calculated for the questions and the participating students are independent with respect to the sample used (Aiken, 1979, 2003; Finch, French, 2015; Furr, Bacharach, 2013; Hambleton et al., 1991; Hambleton, Jones, 1993; Muñiz, 2010; Zamri Khairani, Shamsuddin, 2016).

Taking this into consideration, we used IRT to study the test corresponding to the first round of ST_II, specifically with the Rasch logistic model (RM), developed by Rasch in 1980. An important quality of IRT models is that they show the relationship between the variable of interest (in our case the latent variable that measures the students' ability to do statistics) and the probability of answering a certain item right, which can be represented with RM. The RM models operate under three basic assumptions: 1) the function that relates the latent variable and the probability of answering the question right is monotonous and increasing, 2) there is only one latent variable, and this one feature is measured by the entirety of the questions on the test, and 3) there is no correlation between the results of the questions, i.e., the latent variable is locally controlled and independent of each question(Finch, French, 2015).

RM models require the binary codification of each answer to a question (obviously, 1 for right and zero for wrong). Our research looks at three models: 1) the one-parameter logistic model (1PLM), 2) the two-parameter logistic model (2PLM), and 3) the three-parameter logistic model (3PLM). All three models, 1PLM, 2PLM, and 3PLM, can be defined as a three-parameter logistic model (3PLM) (Ark et al., 2016).

$$P\left(x_{ij}=1\middle|\theta_j,a_i,b_i,c_i\right)=c_i+(1-c_i)\frac{e^{a_i\left(\theta_j-b_i\right)}}{1+e^{a_i\left(\theta_j-b_i\right)}} \qquad 1)$$

where $P\left(x_{ij}=1\middle|\theta_j,a_i,b_i,c_i\right)$ is defined as the probability of student j answering right (1), as opposed to the alternative of answering question i wrong (0); a_i represents the slope, given the curvature of the model used; b_i indicates the difficulty of the question; c_i represents the possibility of guessing the right answer to question i; and finally θ_j indicates the ability shown by student j.

3. Results

The ST_II test consisted of twenty multiple-choice questions, with 5 possible alternatives per item; one of them was the right option and the remaining four were distractors. Figure 1 below shows the percentages of right answers compared to wrong answers given by the students that participated in the first round.

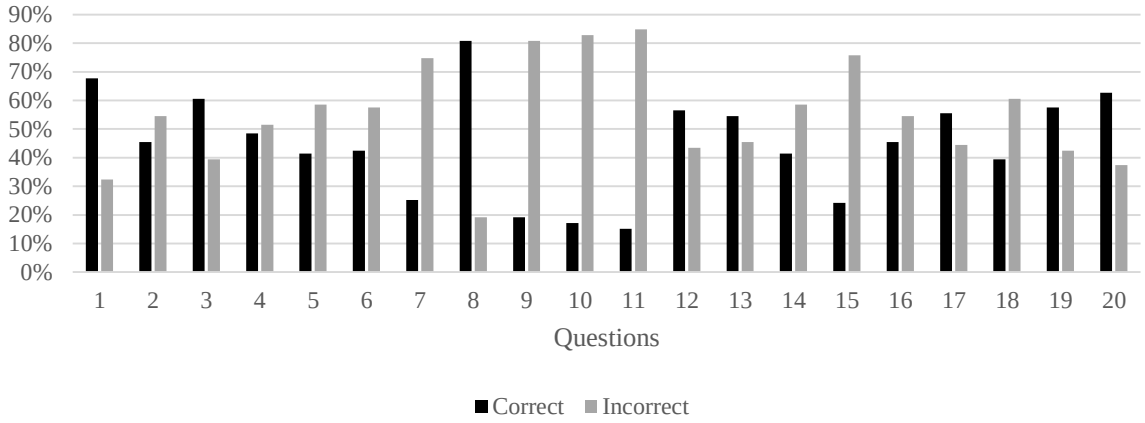

Fig. 1. Percentage of right and wrong answers per test item
Note: prepared by the author based on the results of R

Figure 1 shows a decline in the percentage of right answers from item 1 to 11; after the halfway point, only 4 questions had a higher percentage of wrong answers than of right answers. In summary, 45 % of the items were answered right and 55 % wrong.

Table 1 shows the descriptive statistics results of the applied test. It shows positive asymmetry, i.e., the number of participants with poor scores exceeds the number of participants with good scores.

Table 1. Descriptive statistics

Mean	9.03
Median	8
Mode	6
Standard deviation	3.86
Sample variance	14.89
Kurtosis	-0.73
Asymmetry	0.48
Minimum	3
Maximum	19

Note: prepared by the author based on the results of R

The participants' scores ranged from 3 to 19 right answers, i.e., their grades ranged between 15 and 95 on a scale of 0 to 100. The 20 participants with the highest scores were chosen for the second round, and their scores ranged between 13 and 19 right answers (grades between 65 and 95). The students selected for the second round made up 20.20 % of the total, while 79.80 % were disqualified. Figure 2 shows the percentages of grades obtained by the students who passed to the second round.

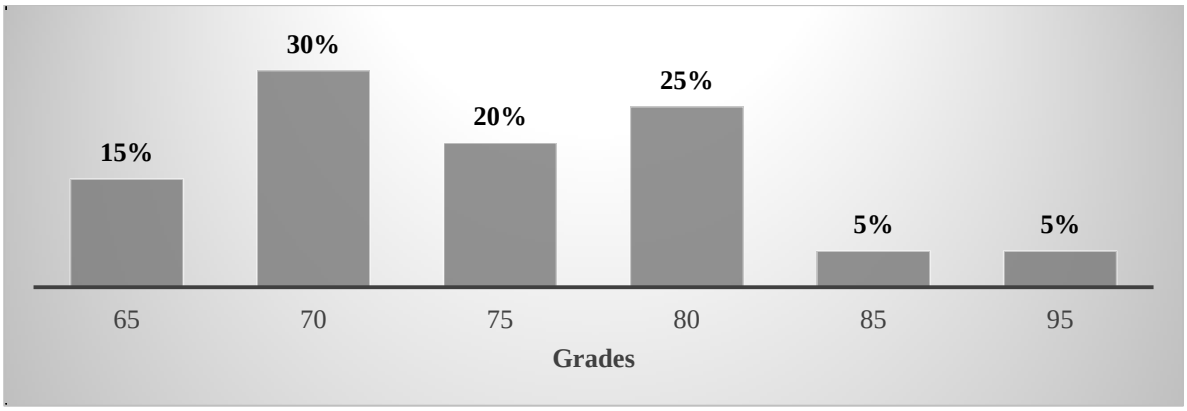

Fig. 2. Percentages of grades obtained by students who passed to the second round
Note: prepared by the author based on the results of R

There are several criteria to select the model (1PLM, 2PLM, 3PLM) with the best fit for the data; for example, the Aikaike (AIC) criterion, the Bayesian criterion (BIC), the likelihood ratio test (LRT), Relative Efficiency (RE), a latent variable simulation through the estimation of the Kernel density function, the information function test, and the goodness-of-fit test. Each of these criteria was applied to determine the model that best fit the data; the results are available from the authors upon request. The criterion that was selected for the model was the BIC, since it suits our purposes better than the Aikaike criterion (AIC). However, there are other criteria that measure the goodness-of-fit of the different models, and a definitive conclusion cannot be reached as to which of them is the best (Finch, French, 2015).

Table 2 shows the statistical information that allowed us to choose the model that best fit the set of available data. It is worth mentioning that 3PLM has a higher BIC statistic than 1PLM, and an AIC below that of 1PLM. It also had better behavior in the results of the aforementioned decision criteria, and on this basis it was decided to apply 3PLM. The information was processed using Latent Trait Models under IRT software (Rizopoulos, 2017), in addition to the free-use statistical package R.

Table 2. AIC and BIC statistical values for the ST_II test

Model	AIC	BIC
1PLM	2382.06	2436.56
2PLM	2360.90	2464.70
3PLM	2348.87	2455.27

Note: developed by the author based on the R results

The results of the 3PLM coefficients are shown in Table 3, ordered from the lowest to the highest level of difficulty. The results for the test's b_i coefficients are ordered from the easiest question (question 3) to the most difficult (question 15). This information coincides with the percentages of right and wrong answers shown in Figure 1. The b_i coefficients can have both positive and negative values; thus, the values close to zero represent questions of moderate difficulty; negative values indicate relatively easy items (below average), while positive values indicate relatively difficult items (above average). However, it can be concluded that the test has a high to average level of difficulty.

The fourth column of Table 3 represents the probability of an average student answering question i right. We can see that this value increases as the question's level of difficulty decreases (Rizopoulos, 2006).

Table 3. 3PLM coefficients and Answer Probability

Items	c_i	b_i	$P(x=1\|z=0)$
3	0.02	-0.33	0.67
12	0.00	-0.21	0.61
4	0.00	0.05	0.48
20	0.30	0.12	0.61
17	0.23	0.26	0.51
19	0.27	0.26	0.54
13	0.26	0.39	0.49
8	0.71	0.55	0.78
18	0.12	0.65	0.30
2	0.22	0.68	0.37
14	0.24	0.95	0.33
16	0.32	1.09	0.38
1	0.60	1.16	0.63
6	0.30	1.22	0.35
7	0.12	1.36	0.17
5	0.35	1.68	0.37
10	0.12	1.99	0.13
11	0.12	2.27	0.12
9	0.17	2.62	0.18
15	0.23	3.04	0.24

Note: prepared by the author based on the results of R

The discrimination coefficient (parameter *a*) that was obtained from the model was 2.10 for each of them, which indicates that the characteristic curve for each of the items has a steep slope, as detailed below.

Table 3 shows that the item with the highest c_i coefficient is item 8, with a b_i value of 0.55 and a *P* value of 0.78. On the other hand, there are two items with a c_i coefficient equal to zero, items 12 and 4; another item near zero is item 3, with a c_i value of 0.02. According to Figure 1, these items were answered wrong by slightly more than 40 % of the students, and item 3 by slightly less than 40 % of the students; however, these are easy items according to the b_i coefficient. Items 7, 9, 10, 11 and 15 had the highest percentages of wrong answers; however, they are relatively difficult items according to the b_i coefficient of 3PLM. A review of the individual scores shows that they were answered right by all the students who advanced to the second round of the tournament.

Figure 3 shows the characteristic curves for each ST_II test question, ordered from lowest to highest level of difficulty. We can observe that the ICC of item 8 shows that students with average ability have a nearly 74 % chance of answering it right. The same goes for item 1, where students with below-average ability have a 60 % chance of answering it right. These graphs show that 90 % of the items on the ST_II test are relatively easy.

The application of the entire information test in the (-10, 10) interval (Baker, 2001; Rizopoulos, 2017) yielded an information total of 25.04; the same test in a (0,10) interval yielded an information total of 20.17, which equals 80.55 %, implying that 19.45 % of the students have an ability level below zero. This behavioral pattern made evident by the test can be seen in Figure 4, in which the total information curve has an approximately symmetrical pattern, skewed slightly toward the left. In this sense, we can conclude that the ST_II test is actually aimed at the highest-performing students of CUCEA in the area of statistics, i.e., those attracted to a challenging and motivating academic competition; this leads to the conclusions that the ST_II adequately meets the

objectives proposed by the DQM in terms of actively promoting meaningful and competitive learning among students.

We conducted a Kernel Density Function test to calculate variable θ (ability) for our data set, which resulted in an estimated value tending toward zero, with an asymmetrical behavior skewing positive, which closely resembles the behavior observed on the total information curve in Figure 4.

The calculated ability level of the 20 students selected for the second round ranged between 0.72 and 3.33, and the rest of the participants scored between -2.00 and 0.47. Of the latter group, 65.67 % have below-average ability, which suggests that the ST_II test does select the most capable students for the second round of the contest.

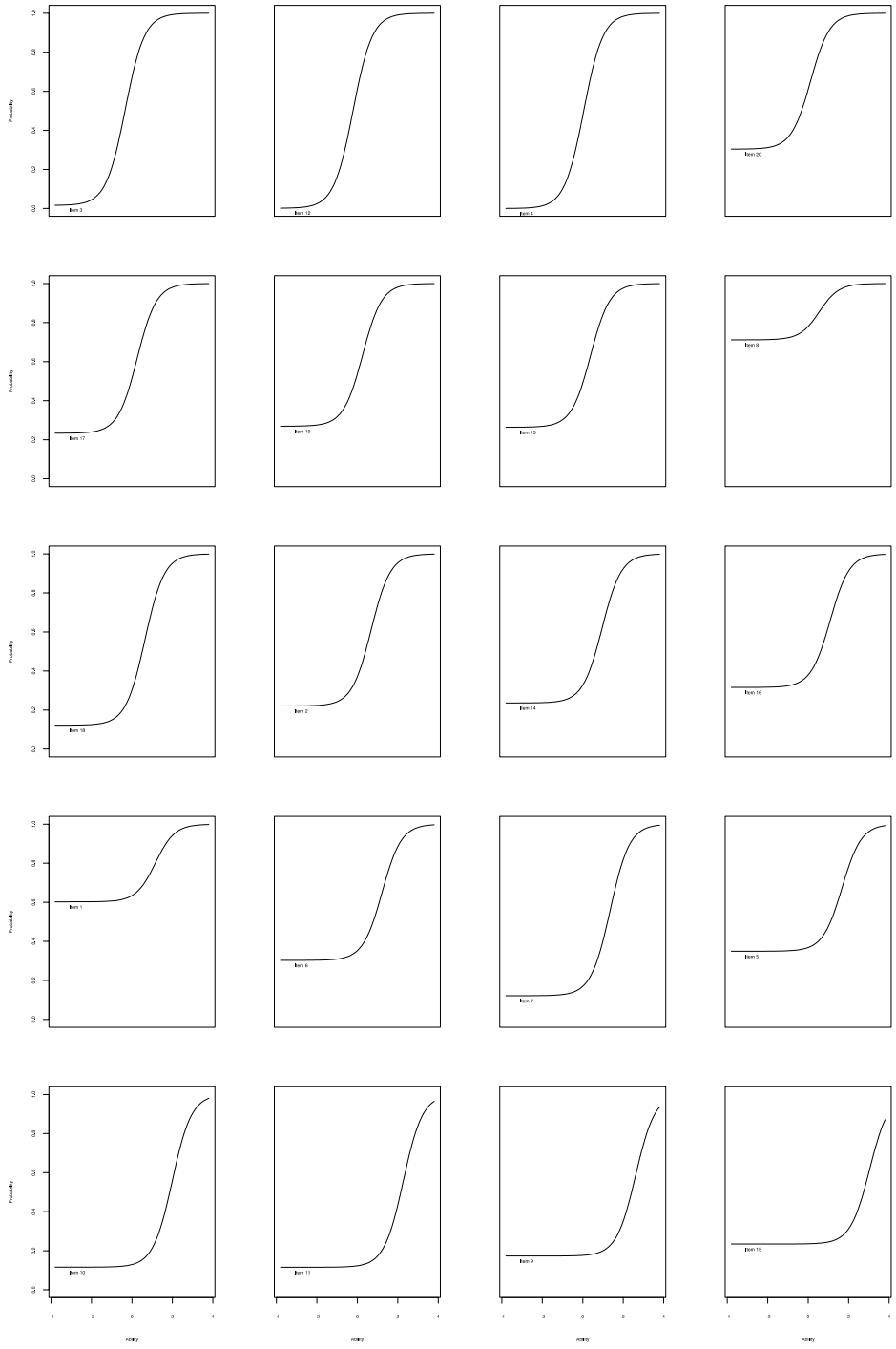

Fig. 3. Characteristic curves by question
Note: prepared by the author based on the results of R

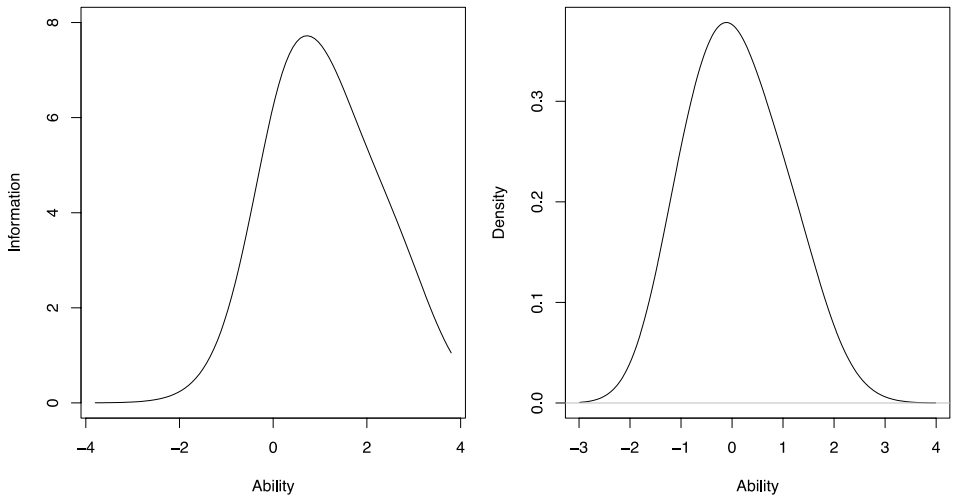

Fig. 4. Test Information Function and Kernel Density (left and right)
Note: prepared by the author based on the results of R

4. Conclusion

This research is the first study to use IRT to look at the application of a multiple-choice test in a university-level statistics competition that promotes active and competitive learning among students. However, a literature review finds similar studies using IRT for partial and departmental exams from a wide range of undergraduate courses (Awopeju, Afolabi, 2016; Balmori et al., 2011; DiBattista, Kurzawa, 2011; Escudero et al., 2000; Gajjar et al., 2014; Ingale et al., 2017; Marie, Edannur, 2015; Mitra et al., 2009; Rao et al., 2016; Romero et al., 2015).

Given the results of our research, we can conclude that the exam taken by students in the ST_II competition is designed for well-prepared students with above-average abilities for statistics. The students chosen for the final round achieved grades between 65 and 95. IRT theory distinguishes between the different types of ability that students show on a particular test, while also considering whether the question options (distractors and right answers) were well designed (McDonald, 2017) since they can significantly influence the results and conclusions derived from the data (DiBattista, Kurzawa, 2011).

The ST_II competition is an attempt by the DQM to promote active and competitive learning, as well as to provide high-level academic challenges for CUCEA students. Student participation fell below expectations, since only a small portion of the eligible students took part. However, we were able to show that those who did participate constitute a small core of students who are genuinely interested in competing intellectually in statistics, and are implicitly motivated by the course they are taking.

Furthermore, we suggest that the professors who designed the ST_II test undertake ongoing training in the design of questions that assess academic performance, since our research showed that most of the items are similar to the problems and exercises found in statistics textbooks, which are not necessarily ideal for this type of event. We also suggest a general evaluation of the teaching activities to ensure that they are aligned with the objectives and contents of the ST_II: this will help to devise a robust and well-designed set of questions for future events (Zamri Khairani, Shamsuddin, 2016).

5. Acknowledgments

We would like to thank the DQM and the Academy of Statistics at CUCEA for providing the information needed to conduct this research.

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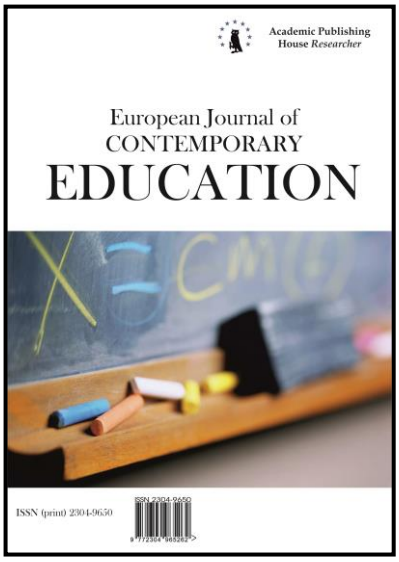
Published in the Slovak Republic
European Journal of Contemporary Education
E-ISSN 2305-6746
2018, 7(3): 458-464
DOI: 10.13187/ejced.2018.3.458
www.ejournal1.com



Stereotypes of Teenagers' Images in Audiovisual Media Texts about Schools and Universities

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Abstract

Having analyzed over a thousand of audiovisual media texts, the authors of the article conclude that in the Soviet, Russian and Western cinema stereotypes of teenagers as positive characters can be divided into the following main groups: 1) positive leaders (high achievers); 2) "nerds" (overly diligent students), 3) average performers. Naturally, the Soviet cinematography had to be more or less ideologically filled with communist values, while in the West and in modern Russian cinema, individual, family and / or group values come to the fore.

Stereotypes of teenagers as villains/ evil characters can be, in the opinion of the authors, represented by the following groups: 1) offenders and criminals; 2) narrow-minded/struggling students; 3) "silver spoons" (representatives of the rich "golden youth"). There are nuances, too. For example, in the Soviet cinema heirs of wealthy families were replaced by handsome egoists from the intellectual background, and there were far fewer juvenile offenders than in the American and European media texts. The Soviet cinema (with the exception of a few *perestroika* pictures) did not emphasize schoolchildren's sexuality.

In general, the analysis of stereotypes of teenage images in audiovisual media texts on the theme of the school and university shows that, despite the national, sociocultural and ideological differences, the stereotypes of these images have more similarities than differences.

Keywords: character, stereotype, media text, film, school topic, students, university.

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1. Introduction

In this article, we address stereotypes of teenage images in audiovisual media texts on the topic of school and university. As in our previous work (Fedorov et al., 2017), we rely on technologies developed by C.Bazalgette (Bazalgette, 1995), A. Silverblatt (Silverblatt, 2001: 80-81), W.J. Potter (Potter, 2001) and U. Eco (Eco, 1998; 2005).

2. Materials and Methods

The material of our research is comprised of audiovisual media texts on the theme of school and university. The main method is character analysis. To identify the main stereotypes of characters, we have studied 1107 audiovisual media texts (feature films, TV series, music videos) related to the subject of the school and university.

3. Discussion

Researchers have repeatedly tackled the topic of stereotypical images of teenage images (with emphasis on gender aspects) in media texts (Álvarez-Hernández et al., 2015; Atkinson et al., 2011; Bachen, Illouz, 1996; Behm-Morawitz, Mastro, 2008; Bleakley et al., 2008; Brown, et al., 2005; Celestin, 2011; Cushion et al., 2011; Driesmans et al., 2016; Halffield, 2017; Halffield, 2017; Jupp et al., 2011; Larken McCord, 2008; Zheltukhina et al., 2017; McDonald, 2008; O'Neill, 2016; Pai, Schryver, 2011; Rufer, 2014; Santiago, 2013; Seif, 2017; Signorielli, 1997; Stern, 2005). In particular, it was noted that the media of the second half of the XX century – the beginning of the 21st century portray young people in an unbalanced way, that is, rather negatively than positively, and negative image stereotypes (juvenile crime, alcohol/ drug addiction, etc.) lead to increased public fears, which do not correspond to the real state of affairs. In doing so, *Guardian*, for example, is likely to rely on facts, whereas articles about young people in *The Daily Mail* or *The Sun* appeal to emotions. In contrast to media representation, facts state that, for example, 70 % of stab wounds are not related to juvenile delinquency (Jupp et al., 2011: 23-25), and the overwhelming majority of young men and women are law-abiding, keen on education, sports and creative activities, whereas media prefer to highlight stories related to youth crime. Moreover, modern media texts often create the image of adolescent egoists who do not relate to parents and civil/social obligations (Stern, 2005: 23-28). This kind of selective media information about teenagers leads to stereotyping of their images to crime, cruelty, laziness, imbalance, disrespectful attitude towards elders and peers, etc. (Jupp et al., 2011: 23-25).

At the same time the influence of romantic media stories about the ideal relationship of adolescents in recent years is becoming weaker (Driesmans et al., 2016), although, of course, the cliche of a "good girl", young, pure, innocent, and kind, waiting for her prince charming may be found in media texts XXI century as well (Álvarez-Hernández et al., 2015; Santiago, 2013).

Another lop side of modern media is the emphasis on young gays and lesbians, which again gives a disproportionate impression of the percentage ratio between heterosexual and homosexual teenagers. At the same time, in a certain part of the media texts, heterosexuals (both adults and young) are presented as conservative characters who neither accept nor support the spread of homosexual relationships (Seif, 2017: 40).

As for the role of media in activation of young people's sexuality, the research shows that sexually coloured media texts (incl. melodramas, comedies, television shows, music videos, etc.) create the illusion of the widespread prevalence of hypersexual activity and experiences of adolescents, and judging by these media texts, sex occupies 90% of the life sphere (Ward, 2003: 347). As for visual media hypersexualization of characters, it is important to note that it is more pronounced in female images, including complete nudity or close-ups of body parts (Álvarez-Hernández et al., 2015). It is clear that the sexist media messages perceived by the teenage audience to some extent influence the development of the personality of teenagers, and their social roles in the future.

In the part of gender analysis of media texts, researchers note (Halffield, 2017: 60) that in recent years comedy series / films have been creating their stories in such a way that rude treatment of girls, including sexual violence, can be perceived as an everyday routine that does not deserve any legal or ethical evaluation. Gender stereotypes of media images of teenage bodies (especially vivid in social networks) can appear both idealized and sexualized (Pai, Schryver, 2011:

31-32). Being able to create photos/videos and instantly upload them on the Internet, a teenager today is no longer a passive receiver but a sender of media messages as well. Some of the most common teenage messages are "selfie": exploring their body abilities, some teenagers take pictures of themselves not only in defiant, sexual poses, but also in situations dangerous to their lives (on the roofs, on top of trains, etc.). For the record, in the Soviet cinema a naked teenage body, of course, was tabooed, and first appeared in the drama *Tomorrow Was the War* (1987), where a high school student is featured examining her breast in front of the mirror.

Alcohol consumption plays a significant role in media stereotyping of teenagers. In modern audiovisual media texts, young people who consume alcohol are rarely positioned negatively. As a rule, these are attractive guys and girls, whose use of alcohol in no way leads to dependence on it, on the contrary, serves as a trigger to start fun adventures and pleasures. In many TV shows, films, commercials, alcohol consumption is seen as acceptable (often glamorous), which does not cause any problems. Moreover, studies have shown (Atkinson et al., 2011) that even condemning the image of (non-extreme) intoxication and the associated inappropriate behavior of a teenager can still send a signal to a teenage audience that such a phenomenon is generally accepted and normal. The alcohol theme in media texts with the participation of teenagers is gender-specific: while female characters may drink a half-glass of champagne (female drunkenness usually causes condemnation), for male teens alcohol is often served as a truly “man’s” activity (Atkinson et al., 2011).

Media stereotypes of teenage images are also manifested in relation to ethnic and national characteristics. For example, black adolescents are regularly associated with negative news and stories (crime, violence, aggression, etc.) (Cushion et al., 2011: 87-90). As for particular national examples, we may mention the media image of a French teenager in American media texts: on the one hand, French characters appear elegant, romantic, seductive, temperamental, artistic, cook well, observe etiquette and follow fashion, and on the other hand - unfriendly, arrogant, imperious, confrontational, selfish, immoral, do not respect rules, procedures or time limits; eat sweets but stay slim; can speak English, but prefer not to (Ferber, 2008: 20).

4. Results

Teenagers as positive characters, their values, ideas, clothing, vocabulary, body language, dwelling.

Positive leaders: students with humanistic (in Soviet media texts – socialist) values, as a rule, neatly dressed, attractive in appearance, artistic/expressive verbal and non-verbal communication. As a rule, they come from ordinary families (live in comfortable apartments or houses), they lead "average" students, organizing various charity and useful things. They study well, do not drink or smoke, do not use abusive language and, of course, oppose any drugs. They are self-confident altruists, who are accustomed to set serious (often socially significant) goals and achieve them (male characters usually win at school academic or sports competitions, and female – in music or dance contests). They can resist any attempt of negative influence. They are fit, dressed simply, but neatly, they have nice looks and voice. There might occur romantic relationships’ problems, of course, but they are eventually resolved in the best way.

Examples in Soviet cinema: *Timur and his Team* (1940, 1976), *Vasek Trubachev and his Comrades* (1955), *Practical Joke* (1976), *Troublemaker* (1978), etc.

Examples in Russian cinema: *Students* (2005), *High School Students* (2006-2010), *Freshman* (2016), *Save Pushkin* (2017), etc.

Examples in Western cinema: *College Swing* (USA, 1938), *Grease* (USA, 1978), *Elections* (USA, 1999), *The Emperor's Club* (USA, 2002), *Freedom Writers* (USA-Germany, 2007), etc.

"Nerds" (very diligent, hard-working students): the main type of activity is excellent study and self-analysis. These intelligent kids from ordinary families (though they may sometimes have a single parents or their parents may be quite eccentric) are not interested in power over people (although they hope for their future professional success). They do not use alcohol and drugs, but often experience sexual problems, are sometimes reserved, shy (sometimes due to the fact that they are bi/homosexual), carelessly dressed and, as a rule, clumsy. Usually they do not use rude language and obscene gestures. In the finale of some media texts, they are transformed as "Cinderella": radically changing their appearance and way of life, they become a subject of admiration by peers.

Examples in Soviet cinema: *Scarecrow* (1983), *Leader* (1984), *Temptation* (1987), etc.

Examples in Russian cinema: *High School Students* (2006-2010), *Scarecrow-2* (2009), *Physics or Chemistry* (2011), etc.

Examples in Western cinema: *Allons z'enfants* (France, 1981), *Mask* (USA, 1985), *Noce blanche* (France, 1989), *Jack* (USA, 1996), *Física o química* (Spain, 2008-2011), *Song for a Raggy Boy* (Ireland-UK-Denmark-Spain, 2003), etc.

Average students: have typical teenage interests and problems related to school, family, and love experience, they are law-abiding, heterosexual, sociable (quite often they find a common language with both parents and teachers), they are handsome, have pleasant voices and good manners; live in good (by the standards of the particular society) living conditions.

Examples in Soviet cinema: *Red Tie* (1948), *The Story of the First Love* (1957), *Wild Dog Dingo* (1962), *Someone is Ringing, Open the Door /The Girl and the Buglar* (1965), *I Loved You …* (1967), *Man-to-Man Talk* (1968), *The Transitional Age* (1968), *Woodpeckers don't have headaches* (1974), *One Hundred Days After Childhood* (1975), etc.

Examples in Russian cinema*: What a Wonderful Game* (1995), *American* (1997), *Let's Make Love* (2002), *The Disappeared Empire (Love in the USSR*) (2007), *Physics or Chemistry* (2011), *Chastnoe Pionerskoe/I Give you my Word* (2012), *14+* (2015), *The Good Boy* (2016), etc.

Examples in Western cinema: *Goodbye, Mr. Chips* (USA, 1939), *Maddalena … zero in condotta* (Italy, 1940), *Future Stars/Futures vedettes* (France, 1955), *Picnic at Hanging Rock* (Australia, 1975), *Física o química* (Spain, 2008-2011), *Freedom Writers* (USA-Germany, 2007), etc.

Teenagers as "villains"/negative characters/antagonists, their values, ideas, clothing, vocabulary, body language, dwelling.

Offenders and criminals: the main type of occupation – various types of offenses (including domestic violence), crimes (including murder, drug trafficking, which is more common for male characters), smoking, alcohol and/or drugs consumption, sex. In Western media texts such characters are often African American or Latin. They are selfish, cruel and self-confident. Their appearance and vocabulary can be of any type, but basically they use rough vocabulary, have sharp voices and use obscene gestures. In many cases, they are defiantly dressed and have a sporty physique (male characters), wear a bright makeup and are slim (female characters), although there are different options for appearance and clothing. In relation to education, there are two main options: complete ignoring/skipping classes and/or aggressive behavior during classes, or, conversely, such characters study well, skillfully concealing their secret vices, criminal inclinations and psychological manipulation. Basically, they are teenagers from poor families (in this case they often live in horrible living conditions), but there are also characters with rich parents.

Examples in Soviet cinema: *My friend, Kolka!* (1961), *The Republic of ShKID* (1966), *Minors* (1976), *The Last Chance* (1978), *Recognize Guilty* (1983), *Plumbum, or the Dangerous Game* (1986), etc.

Examples in Russian cinema: *Teacher-in-Law* (2007), *School* (2010), *Physics or Chemistry* (2011), *Student* (2016), Alex Sparrow's music video *I Love You* (2017), etc.

Examples in Western cinema: *Crime School* (USA, 1938), *The Blackboard Jungle* (USA, 1955), *School: Confidential!* (USA, 1958), *Delinquent School Girls* (USA, 1975), *La liceale seduce i professori* (Italy, 1979), *Class of 1984* (Canada, 1982), *Class of Nuke 'Em High* (USA, 1986), *Zombie High School* (USA, 1987), *Class of 1999* (USA, 1990), *Kids (*USA, 1995), *One Eight Seven* (USA, 1997), *Devil in the Flesh* (USA, 1998), *La journee de la jupe, France* (Belgium, 2008), *Jennifer's Body* (USA, 2009), *Polytechnique* (Canada, 2009), *The Perfect Student (*USA, 2011), *Hello Herman (*USA, 2012), etc.

Narrow-minded/struggling students: the dominant activity is a primitive pastime (including surfing the entertainment sector of the Internet), boredom in class, absenteeism, a habit of being a laughingstock in class and at home. They are usually lazy, not self-confident, possess scant knowledge and skills. Clothing and vocabulary in this case can be any, but the appearance is rather unattractive, and the body either overweight or awkward. Their social origin is differentiated, although for the most part these teenagers are from underprivileged families.

Examples in Soviet cinema: *We'll Live To Monday* (1968), *The Big Break* (1972), *Asthenic Syndrome* (1989), etc.

Examples in the Russian cinema: *Everybody Dies but Me* (2008), *Physics or Chemistry* (2011), *Corrections Class* (2014), *The Teacher* (2015), etc.

Examples in Western cinema: *La professoressa di scienze naturali (*Italy, 1976), *La liceale nella classe dei ripetenti* (Italy-France, 1978), *Les sous-doués* (France, 1980), *Screwballs* (Canada, 1983), *Loose Screws* (USA-Canada, 1985), *One Eight Seven* (USA, 1997), *La journee de la jupe (*France – Belgium, 2008), etc.

"Silver spoons" (representatives of the rich "golden youth"): their main activity is dominance, which can include offence (for example, domestic violence) and even crimes. To a greater extent these people come from wealthy white families (possessing chic mansions and expensive cars), are interested in power over people and sex, rather than using alcohol and drugs (the latter may take place, but in moderate doses). They are selfish, sarcastic, ironic and self-confident, expensive and fashionably dressed and, as a rule, handsome, speak with pleasant voices. Sometimes they can use rough vocabulary and obscene gestures. They study mostly very well, but despite excellent studies, sometimes hide secret vices and psychological manipulations.

Examples in Soviet cinema: *Certificate of maturity* (1954), *We'll Live to* Monday (1968), The *Practical Joke* (1976), *Temptation* (1987), *Dear Elena Sergeevna* (1988), *The Jester* (1988), *Darling Ep* (1991), etc.

Examples in Russian cinema: *School No. 1* (2007), *Yulenka* (2008), *Barvikha* (2009), *Seniors* (2006-2010), *Golden. Barvikha-2* (2011), *Physics of Chemistry* (2011), *Chastnoe Pionerskoe- 3 / I Give you my Word-3* (2017)*, etc.*

Examples in Western cinema: *Gross Misconduct* (Australia, 1993), *Apt Pupil* (USA-Canada-France, 1997), *Física o química (*Spain, 2008-2011), *Election* (USA, 1999), *The Emperor's Club* (USA, 2002), *Jennifer's Body* (USA, 2009), *Dans la maison* (France, 2012), *Dismissed* (USA, 2017), etc.

5. Conclusion

In Soviet, Russian and Western cinema stereotypes of teenagers as positive characters can be divided into the following main groups: 1) positive leaders (high achievers); 2) "nerds" (overly diligent students), 3) average performers. Naturally, the Soviet cinematography had to be more or less ideologically filled with communist values, while in the West and in modern Russian cinema, individual, family and / or group values come to the fore.

Stereotypes of teenagers as villains/ evil characters may be, in our opinion, represented by the following groups: 1) offenders and criminals; 2) narrow-minded/struggling students; 3) "silver spoons" (representatives of the rich "golden youth"). There are nuances, too. For example, in the Soviet cinema heirs of wealthy families were replaced by handsome egoists from the intellectual background, and there were far fewer juvenile offenders than in the American and European media texts. The Soviet cinema (with the exception of a few *perestroika* pictures) did not emphasize schoolchildren's sexuality.

In general, the analysis of stereotypes of teenage images in audiovisual media texts on the theme of the school and university shows that, despite the national, sociocultural and ideological differences, the stereotypes of these images have more similarities than differences.

6. Acknowledgements

This research was funded by the grant of the Russian Science Foundation (RSF, project No. 17-18-01001) at the Rostov State University of Economics. Project theme: "School and university in the mirror of Soviet, Russian and Western audiovisual media texts". Head of the project is professor A.V. Fedorov.

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Published in the Slovak Republic
European Journal of Contemporary Education
E-ISSN 2305-6746
2018, 7(3): 465-484
DOI: 10.13187/ejced.2018.3.465
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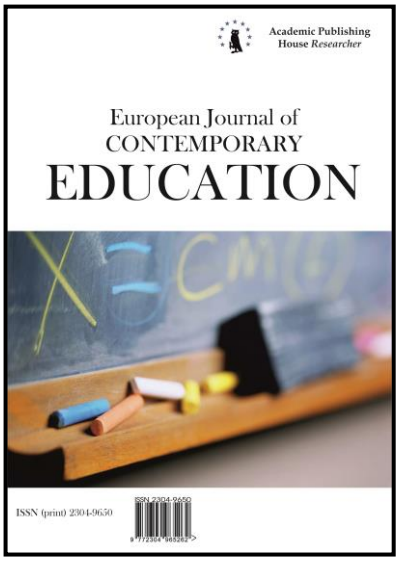

Inclusion of Techno-Pedagogical Model in Mathematics Teaching-Learning Process

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Abstract

The aim of this work is to know the perception of the high-school student towards the teaching process of the Financial Mathematics under the modality assisted by the technology. The EAPHMF Scale designed by García-Santillán and Edel (1988) was used, which collects data associated with the student's perception of the variables that make up the techno-pedagogical model. Fifty two students were surveyed in a private institution. The results show that, as a whole the variables of the techno-pedagogical model favor the student's perception toward financial Mathematics being the ones that most contribute, the workshop-type class followed by the design of financial simulators. Furthermore, in the intervention process, an improvement in the evaluation of learning was observed.

Keywords: techno-pedagogical model, ICT, perception, financial mathematics, spreadsheet.

1. Introduction

During the 21st century, the use of technology has extended to every human activity around the world. Certainly, the automatization of productive sectors, to name an example, has been favored with the inclusion of information technologies. Another area that has been benefited – related to the object of study – is education. Namely, the teaching-learning processes of different graduate programs and special fields offered in the educational system worldwide, and specifically in Mexico, include ICT in their formation processes, seeking to develop more and better competencies in individuals.

From the 1970s, some researchers like Feierabend (1960) dedicated their study to measure the attitude of students towards Mathematics, but these studies were not done in detail (García, Juárez, 2011). In 1976, Fenemma and Sherman took on the task of measuring anxiety towards

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Mathematics in men and women. Other studies were added to the body of knowledge in such period, trying to measure different factors that students usually present towards Mathematics, such as confidence, mathematical interaction and computers, commitment, motivation or usefulness, among others (Galbraith, Hines, 2000). Nonetheless, from such studies, research about this area has notably increased, especially since students perceive Mathematics as a difficult, boring and abstract subject, as stated by Gil, Guerrero and Blanco (2006).

In recent years, teaching-learning processes have changed due to the presence of information technologies, and Mathematics has not been an exception because ICT have been included in learning formation models assisted by technology, an example of that are the proposals by García-Santillán and Edel (2008) and García-Santillán et al. (2010) about a techno-pedagogical model that has aided students in improving the understanding of subjects in financial Mathematics by visually – with financial simulators – taking the image of concepts they considered abstract to a more technological view, specifically regarding financial simulators.

The later are the resulting elements of the setup of the afore-mentioned model since these financial simulators are designed by the students as product evidence of the techno-pedagogical model. In support of this, some authors have shown the great accomplishments obtained by students in the Mathematics teaching processes aided by ICT, since they can simulate scenarios and present different economic situations to be solved (Domínguez et al., 2008 quoted in Maz et al., 2012).

Along those lines, ICT provide different tools that can be used for the teaching of Mathematics: the use of spreadsheets, simulators and virtual platforms, among others; these tools can change the student´s perception towards this subject and have improved students´ final grades (Benítez et al., 2011).

On this regard, Williamson and Kaput (1999) pointed out that everything related to computational means is linked to the virtual culture, because it is there where the fifth cognition stage is developed, that is where new forms of mathematical representation can be created, which can be manageable and changing. The former causes the development of processing and storing capacity for each step and rules within the system, which derives in the virtual culture.

It is clear that technology does not come to solve the existing problems in the Mathematics teaching-learning process, but it is indeed a fact that technology is an aiding or assistance tool for a transformation in Mathematics education (Gómez-Chacón, 2010). The important role of ICT is precisely the transformation of said education processes for visual representation and creation of scenarios in mathematical problems modeling and solving.

In the field of Mathematics, solving a problem that involves too many variables or elements that constitute theorems is certainly complex and developing them manually has been the traditional teaching school. This argument can sustain the justification about the importance of technology use in the teaching process, since the aim of its use is exactly being able to show the way of simplifying the complexity of a certain situation.

Technology can also assist in the area of environment, as it intervenes with symbolic systems too; technology has an important role that goes from designing to aiding the teaching didactic system (Gómez-Chacón, 2010).

Student considers more attractive to be able to interact with several possible scenarios of problem solving because thought connects to the visual algorithm and hence, makes the student think while interacting with cognition. In such manner, he/she learns by using visual and graphic representations with algorithms through graphic calculators and computers which eases the learning of Mathematics (Hitt, 1998).

Lupiánez and Moreno (2001) state that the main use of computer and calculators is using the calculation system, through computerized formulas. They argue that with the use of computers vectors, matrixes, numeric solutions and trigonometric operations, among others, can be appreciated. Even if it is true that technology can benefit the learning process, its regular use can be detrimental since the student can forget what he/she can do with paper and pencil. Technology must be used carefully, to enrich the process of developing cognitive skills and not as a substitution (Lupiánez, Moreno, 2001).

Likewise, Santos (2001) points out that technology is essential for the teaching and learning of Mathematics, as it eases the making of calculations in an efficient and precise manner. In his study, he mentions that students focus more because they pay attention when making decisions,

helps them ponder and reason each scenario to be solved using calculators and computers. It is obvious that Mathematics has a steady presence in our environment, hence examples and situations that can be shown to students are a way of proving its application on different moments of daily-life and the areas it can encompass (Godino et al., 2003).

With the support of these arguments, the main focus of this study is to identify the factorial structure of latent variables that allow measuring the student´s perception towards the Mathematics teaching process supported by a techno-pedagogical model. As a result, it is pertinent to question: how does the undergraduate student perceives the Mathematics teaching-learning process assisted by ICT? And similarly: what is the factorial structure of the techno-pedagogical model that contributes more to the explanation of the study phenomenon?

To provide answers for these questions and achieve the main purpose of this research, the theoretical model posed by García-Santillán and Edel (2008) will be replicated, considering the variables of the scale that measures attitude and perception towards Financial Mathematics (EAPHMF) and thus, the construct is presented next:

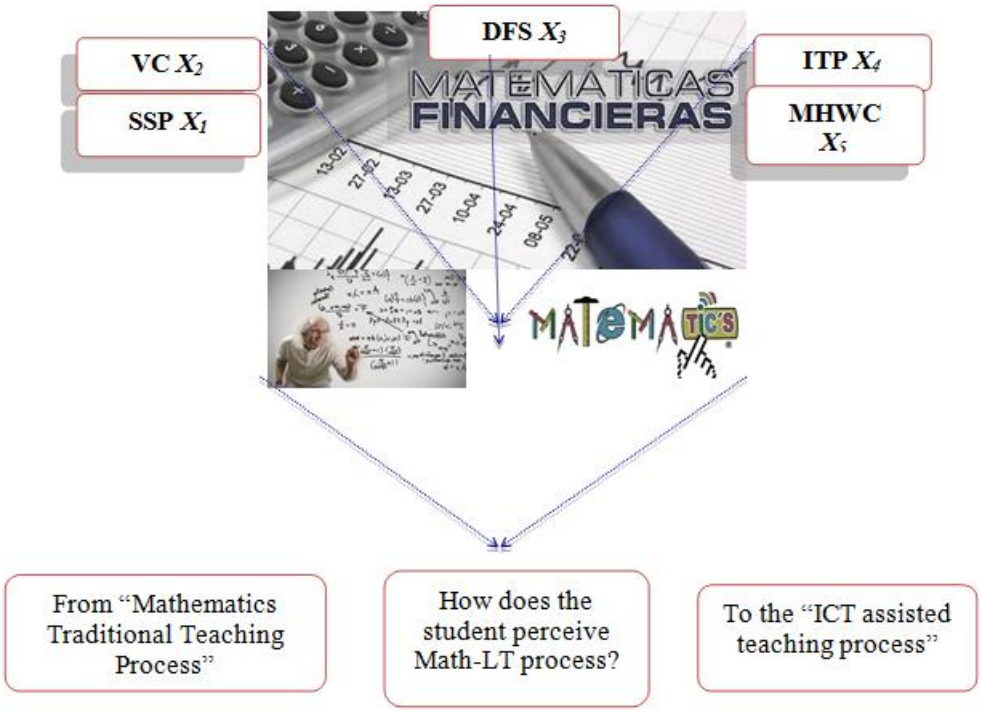

Fig. 1. Study conceptual model EAPHMF (García-Santillán, Edel, 2008)

Where: VC: Virtual communities; DFS: Design of financial simulators; MHWC: Content of Mathematics history and workshop class; SSP: Spreadsheet programing; ITP: IT platforms.

Source: Images taken from Google.Mathematics traditional teaching process
URL: http://blogconamat.blogspot.mx/2012/05/objetan-ensenanza-tradiconal-de.html

Therefore, in order to measure perception towards Financial Mathematics (FM) and the inclusion of Information and Communication Technologies in the teaching processes, it is necessary to discuss the theory and empirical evidence of both constructs.

2. Literature review

The variables implied are framed in the following theories and empirical evidence: Mathematics History promotes a change in the attitude towards the subject, according to the statement Furinghetti and Somaglia (1998), the students still holds the belief that Mathematics is

abstract and is only found in the mind of professors and that practically everything has been discovered in this area; the author also mentions that for them, it is a boring subject lacking imagination. However, Bell (1985: 54) postulated that Mathematics is one of the disciplines that loses the most when its history is excluded from the teaching process.

In the study by González-Urbaneja (2004), the author presents very significant theoretical arguments. Along the document, it extracts important arguments from great mathematicians, pedagogues and historians that have provided theoretical basis to this variable of Mathematics history as didactic resource, mentioning: *Poincaré, Klein, Toeplitz, Köthe, Bell, Courant, Puig Adam, Lakatos, Kline, Santaló..... (sic)*.

It is important to identify the origin that builds the historic roots of Mathematics, as Courant has referred in the prologue of "*The History of the Calculus and its conceptual development*" (Boyer, 1949). For instance, Fauvel (1991), based on the opinion of Gellert (2000), states that it is necessary to use Mathematics history in the teaching-learning-evaluation (TLE) process of the subject, by using comparative studies between: the methodology used in the moment and context of the student and analogously, in a different cultural context (Pizzamiglio, 1992; Bidwell, 1993; Murugan 1995).

Likewise, Clinard (1993) and Fauvel (1991) support the argument of including "Mathematics History" as an important component in T-L-E processes of this subject, but also for the teacher, since it allows him/her to visualize Mathematics from another perspective. Clearly, the great absent of Mathematics teaching process has been its own history, that is, its birth and how it has evolved until today.

It is interesting to know the controversies and conflicts between the great scientists for the development of this discipline. Also, it must not be forgotten than these debates caused regression and stagnation too, until the progress known nowadays was achieved (Vidal, Quintanilla, s/f).

The benefit obtained by this methodologic resource is remarkable; actually, in a study carried out by Chávez and Salazar (2006), the authors assert to have incorporated this technique in an algebra subject with excellent results, among which the following stand out: development of oral and written expression skills, attitude change in students (interest, collaboration and disposition).

On the other hand, Salinas (2010) made an experiment in which Mathematics history (MH) is applied with the purpose of observing geometry students to know their attitude towards MH topics, besides observing if this didactic resource encourages the student to introduce him/herself in the deductive sense of geometry.

Nowadays, one of the strongest tendencies in education is the one that presents the Mathematics teaching process with the use of technologies (Hitt, 1998; Lupiánez, Moreno, 2001; Goldenberg, 2003). In that area, the use of computer spreadsheets has allowed a noticeable advancement because it has enabled the development of financial projections automatically, just by using a set of values. In this respect, Moursund (1999, 2003 and 2007) has stated repeatedly that for solving problems from a business context, exact and social sciences, as well as other knowledge disciplines, the spreadsheet offers a beneficial environment for the modeling of said problems.

In the teaching of financial Mathematics, other significant mechanism for learning is the creation of a virtual community, that is, an space in IT platform where people (who will learn) and instruments (means to learn) can be integrated; hence, in the words of Pazos et al. (2001), *"virtual communities" are considered as web-based environments that group people related to a specific subject, who besides the distribution lists (first node of the virtual community) share documents, resources, among others.*

In the same idea, Hunter (2002) declares that virtual communities have been created to analyze or solve problems and they support the construction of knowledge jointly with its members, in such manner that students would have a higher involvement, active participation, autonomy, interdependence and responsibility, all of that regarding the learning process, culminating in a collaborative and cooperative work. In the same way, Mendoza (2015) carried out a research which shows the formative potential of students in virtual communities. On said study, data revealed that students showed higher skills in the learning process, which lead them to improve their grades, besides leaving them satisfied with the learning experience.

By including the TLE process of financial Mathematics, the variables: simulation and simulators as tools that are created in the "Workshop class", it is pertinent that said tools are

shared to other people, institutions or any other interested in obtaining them, that is, creating a virtual community, where they can be shared.

On that matter, the perspective of Salinas (2003) is relevant as he states that there is a higher probability of achieving virtual learning communities when there are individual interests and affinities among the students who are taking the same subject.

For the former, it is necessary to have a special infrastructure and a platform to create virtual classrooms (VC), being Moodle one of the best options, since it has a pleasant environment. Moodle pretends to be a platform to create virtual courses of any subject, as well as being an excellent tool that complements educational community, without space and time limits (Dougiamas, Taylor, 2002, 2003; Costello, 2014).

It is important to highlight that in the learning-teaching process, perception plays an important role because a large part of interest in learning depends on the attributes of each student and therefore, the teacher must take into account the influence of this factor in the teaching-learning process.

From a pedagogic point of view, the teaching-learning process of this subject can be configured around the theories of Bruner and Ausubel (Roca, 1991), these authors affirm that learning is produced by the interaction of the previous mental schemes of the subject, as well as the new information from the environment, where new information in the knowledge and learning process does not substitute previous knowledge of the student, but it is an interaction with the ones already present.

To sum up, the variables involved in the techno-pedagogic model have been fundamental in several studies, such as the case of Mathematics History as methodological resource in the teaching-learning process (Fauvel, 1991; Russ, 1991; Pizzamiglio, 1992; Moreno, Waldegg, 1992; Clinard, 1993; Toumasis, 1995; Barbin, 1997; Nuñez, Servat, 1998; Ernest, 1998; Fauvel, Manen, 1997; Furinghetti, 1997; Chávez, Salazar, 2006 and Salinas, 2010), the construction of simulators as didactic tool for the teaching process and the case of Excel spreadsheet (Barbin, 1997; Goldenberg, 2003; Lewis, 2006; Mousround, 2007; Niess, 1998; García-Santillán et al., 2008).

Virtual environments as tool for the transference of learning is based on the work by Rheingold (1996, 2001), Hagel and Armstrong (1997), Jonassen et al. (1998), Salinas (2003), for the integration of virtual learning communities and its use in the learning processes (Hagel, 1999; Tarín, 1997; Jonassen et al. 1998; Wallace, 2001; Rheingold, 2001; García-Aretio, 2003; Salinas, 2003; Cabero Almenara, 2004, 2005) and finally, computer platforms as conducting element in the process of distance education (Dougiamas, Taylor, 2002, 2003; Bernabé, Adell, 2006; Costello, 2013).

After the afore-mentioned analysis, the research question is ratified: *How does the undergraduate student perceives the Mathematics learning-teaching process that uses ICT?* As well as, *what is the factorial structure of the techno-pedagogical model that better contributes to explaining the study phenomenon?*

Consequently, the hypothesis is: $\boldsymbol{Hi_1}$ = There is a factorial structure of latent variables that explain the undergraduate student´s perception towards the Financial Mathematics teaching process that uses technology.

3. Method

It is a non-experimental study, descriptive and with factorial analysis of main components. The sample selection is non-probabilistic since it was selected by convenience. The selection criteria consisted on including students of all the bilingual programs at the Business School who were enrolled in the third semester who would take Financial Mathematics as subject. The request for the empiric study and authorization was made by the Business School Dean. The study subjects are shown on Table 1.

Table 1. Studied population

Career program	Students per program	M	W	M	W
Company Management and Direction	10 = 19 %	2	8	3.85 %	15.38 %
Accounting and Finances	14 = 27 %	6	8	11.54 %	15.38 %
Economy	9 = 17 %	5	4	9.62 %	7.69 %
International Markets and Business	19 = 37 %	7	12	13.46 %	23.08 %
Total	52	20	32	38.00 %	62.00 %

As observed in Table 1, 62 % are female, which is a larger number of participants in this study against 38 % of male students. All of them are enrolled at the programs of Company Management and Direction, Accounting and Finances, Economy, International Markets and Business.

The distinctive characteristic of this study group is that they belong to the area of Business *school* (bilingual system) during the first five semesters of their college program and later, they study the specialization during the rest four semesters. There is even the option of double certification with a US college (*South Eastern Louisiana University*), for that, they are required to study the last two years in the USA.

3.1. Instrument

The scale designed by García-Santillán y Edel (2008) and modified in García-Santillán et al. (2010) was used; it collects information about the student´s perception towards variables related to Mathematics History, spreadsheet programming, simulators´ design, computer platforms and virtual communities. The instrument is designed in a Likert scale that ranges from 1, totally disagree to 5, totally agree (Table 2).

Table 2. Dimensions and indicators of the EAPHMF scale

Variable	Code	Items
-Mathematics history and workshop class	MHWC	1,2,5,6,7,9,10,11,12,13,14,15,17
-Spreadsheet programming	SSP	3,8,16,20,21,22,23,26,
-Design of financial simulators	DFS	18,24,25,27,28
-Computer platforms	CP	4,19
-Virtual communities	VC	29,30,31

The internal consistency reported in the original scale design was α=.902 and standardized α=.905 however, the consistency obtained for this study was α=.775 (31 items), α=.791 (typified elements) and α=.770 (grouped in five dimensions), which is an average internal consistency in relation to the theoretical statements recommended by some authors (Hair et al., 1979).

Table 2.1. Case processing summary

Cases	N	%	Cronbach´s Alpha	Cronbach´s Alpha based in typified elements	Number of elements
Valid	52	100.0			
Excluded	0	.0	.775	.791	31
Total	52	100.0			
			.770		5

a. Elimination by list based on all the procedure variables

The descriptive statistics from the five dimensions are shown on Table 3 (mean, deviation variation standard and coefficient), where it can be seen that the CP dimension presents a higher

variation between its mean and standard deviation (15.54 %) against SSP, which presents the lower variation (8.14 %).

Table 3. Descriptive Statistics

Dimensions	Mean	Typical deviation	N of analysis	VC= St Dev./μ
MHWC	49.9615	4.31578	52	8.64%
SSP	31.0385	2.52797	52	8.14%
DFS	19.6923	2.20106	52	11.18%
CP	7.7885	1.21003	52	15.54%
VC	12.2500	1.15258	52	9.41%

3.2. Procedure for data analysis

For the statistical analysis the program Statistical Package for the Social Sciences (SPSS) version 23 was used and the multivariate statistical procedure of exploratory factor analysis (EFA) with main component extraction was carried out, since the information will be summarized in a minimal quantity of factors with prediction purposes in order to answer the main question of the study and achieve the set goal, after the hypotheses have been contrasted.

4. Data analysis and discussion

In order to corroborate the model factor structure of the Scale EAPHMF by García-Santillán and Edel (1988), a EFA is done using the main components method (with Varimax rotation). The results from the measures shown on table 4 are statistically optimal. The sample adequacy KMO (.684), Bartlett's test of Sphericity (Chi^2 71.924, *df* 10 p <0.01), the MSA values (which range from .626 to .851) are theoretically acceptable (>.5) and the positive correlations with a low determinant (.227). These EFA measures allow surpassing significantly the validity and pertinence of the data matrix and continue with the analysis.

Table 4. Bartlett´s test of sphericity KMO, MSA, Correlation and significance

	MHWC	SSP	DFS	PI	VC	*KMO*	*MSA*	Bartlett´s test ($Chi^2_{df\ 10}$)
MHWC	1.000						.675[a]	
SSP	.509	1.000					.626[a]	71.924
DFS	.356	.725	1.000			.684	.710[a]	(α = .000)
CP	.111	.445	.321	1.000			.705[a]	
VC	.144	.394	.379	.179	1.000		.851[a]	

a Determinant = .227

Afterwards, two important steps in the development of the factorial technique take place, the first of them is the analysis of main components with latent root criterion > than 1 with the 31 items grouped in the five dimensions. The second is using the same main components method, but now under the factor criterion (31 items of the scale) with Varimax rotation and Kaizer normalization, as to try to minimize the number of variables that present high saturations and being able to simplify the interpretation of each of the obtained factors.

In table 5, there is the calculation of main components using the Eigenvalues criterion > 1, where it can be seen that the analysis shows a single component with an Eigenvalue of 2.515, which represents 50.30 % of the total variance of the five dimensions in the conceptual study model from Figure 1 (MHWC, SSP, DFS, CP and VC). A second and third component attain a value > than 1 and remain under this criterion (.901 and .824), which combined would provide 84.80 % of the variance.

Table 5. Total Variance

Component	Extraction sums of squared loadings			Rotation sums of squared loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.515	50.299	50.299	1.086	21.716	21.716
2	.901	18.025	68.325	1.062	21.235	42.951
3	.824	16.470	84.795	1.045	20.896	63.847
4	.531	10.629	95.424	1.032	20.644	84.491
5	.229	4.576	100.000	.775	15.509	100.000

Extraction method: principal component analysis.

In the second procedure the factor matrix was rotated, for that, the 5 grouped dimensions were analyzed (Table 6) and afterwards, the 31 items of the scale (Table 6.1), both with the criterion of factorial loadings > .5 and ranked by factor type.

Table 6. Rotated component matrix (a)

	Component				
Dimensions	1	2	3	4	5
DFS	.919				
MHWC		.971			
CP			.977		
VC				.975	
SSP					.795

Extraction method: Principal component analysis. Rotation method: Varimax with Kaiser Normalization.
a The rotation has converged in 5 iterations.

On Table 6, it can be seen that the five factors corresponding to each of the model dimensions (with the 31 grouped items), present high saturations in the following order: Computer Platforms (.977), Virtual Communities (.975), Mathematics History and Workshop Class (.971) and Design of Financial Simulators (.919), although with a lower saturation in comparison to the others, but still with an acceptable factorial loading we find the dimension of Spreadsheet Programming (.795).

Table 6.1. Rotated component matrix (a)

	Component				
Items	1	2	3	4	5
SSP-22	.814				
SSP-23	.766				
DFS-27	.723				
SSP-26	.683				
DFS-24	.599				
DFS-28	.528				
DFS-25		.691			
CP-19		.633			
MHWC-17		.593			
SSP-8			.833		
MHWC-7			.817		
DFS-18			.529		
MHWC-10				.581	

VC-31	.563	
MHWC-12	.559	
MHWC-6		.658
MHWC-1		.654
SSP-3		.653

Extraction method: Principal component analysis. Rotation method: Varimax with Kaiser Normalization. a The rotation has converged in 10 iterations.

The saturations presented by the indicators that have been grouped in each of the five components obtained provide very significant information, given that the integration of each component provides routes or indications of how is the student´s perception regarding the techno-pedagogic model proposed for the teaching of the Financial Mathematics subject.

Therefore, next there is the interpretation of the rotated matrix, with which the extracted latent indicators are identified according to the procedure of rotated component extraction by factors criterion, where the ones with higher saturation (>.5) are extracted.

Table 7. Rotated component matrix (a) Factor 1

Code	Factor 1 (Y_1)
SSP-22	Program the formulas in Excel and work with them in the workshop class aids my learning.
SSP-23	Designing financial tools in an Excel spreadsheet complements my learning.
DFS-27	I really like to learn FM if I can transform the formulas seen during class in financial simulators.
SSP-26	I feel that Excel programming strengthens my learning in FM.
DFS-24	The design of simulators provides added value to my teaching-learning of FM.
DFS-28	It is an incentive when the teacher promotes competition for the best design of simulators.

In factor 1, the six items with saturations > .5 are related to spreadsheet programming and design of simulators, which leads us to think that the student perceives that Excel programming to design financial tools strengthens his/her learning together with the teacher´s incentive of promoting competition for the best simulator.

Table 7.a. Rotated component matrix (a) Factor 2

Code	Factor 2 (Y_2)
DFS-25	Excel programming and design of simulators help me not to reject the teaching-learning of FM.
CP-19	Use of ICT in the learning process of FM generates more interest in me.
MHWC-17	FM generates more interest and expectation when I relate it to real cases and present them in class.

For factor 2, the importance of ICT is noted again, since programming of mathematical formulas that are analyzed in each class session are turned into financial tools in a workshop class, that is, the student designs financial simulators that will also help him/her in professional life, which generates more interest to take the subject under a modality aided by ICT. Also, the use of previously designed financial simulators allows the creation of diverse scenarios to simulate decisions in several possible contexts.

Table 7.b. Rotated component matrix (a) Factor 3

Code	Factor 3 (Y_3)
SSP-8	The terms and symbols used in Mathematics are never difficult for me to understand and handle because the teacher encourages me to create new ways to code them.
MHWC-7	The FM course helps to teach how to think and I can propose some alternatives of solution.
DFS-18	I learn better when the FM subject is taught using other didactic techniques.

The result for factor 3 highlights once again the relevance of ICT, given that the student is motivated by the implementation of alternative ways of learning, different from traditional sessions in the Mathematics teaching process. In the same manner, students are incentivized by been able to code to computer language, the symbols and terms used in the formulas, which helps them propose solution alternatives to the cases been solved in class.

Table 7.c. Rotated component matrix (a) Factor 4

Code	Factor 4 (Y_4)
MHWC-10	It is motivating to carry out a workshop class.
VC-31	I think that using the Web to share knowledge is a good alternative for our education.
MHWC-12	Knowing the history of FM helps me become more interested in the course.

The history of Mathematics and the workshop class is seen again in the fourth factor, which points to the student´s interest to take the subject of Mathematics while integrating the historical aspects of the evolution of said discipline.

In addition, it is possible to see the student´s interest for sharing experiences with other students through virtual communities, which undoubtedly will add to his/her learning.

Table 7.d. Rotated component matrix (a) Factor 5

Code	Factor 5 (Y_5)
MHWC-6	I enjoy FM when the teacher explains how a problem can be solved in different manners.
MHWC-1	FM is enjoyable and stimulating for me when the teacher explains its history.
SSP-3	I think I could study harder FM with the use of the spreadsheet.

In the fifth and last factor, the history of Mathematics and spreadsheet programming are present once more, which leads us to think that the student favorably perceives the role of the teacher, when he/she explains the way a particular exercise has been solved historically, meaning how some Mathematics calculations have evolved with time regarding its resolution path. Even the complexity level can increase as long as spreadsheet is used, since this tool would help solving very complex cases.

The five factors that make up the structure of variables that represents the perception towards Mathematics are indicators of a practical and statistical significance, this means that subject teachers can take them into consideration when making teaching-learning strategies in a way that student is more interested in Mathematics and at the same time, help to reduce the desertion rate of the subject.

5. Discussion and Conclusion

Once the results were analyzed, it can be concluded that there is a structure of variables showing the perception that students from the Business School of Cristóbal Colón University have towards the subject of Financial Mathematics. The results allows seeing that teaching is more

dynamic thanks to Information Technologies, which have opened the way to a different teaching manner, this leads to a change in the student´s perception towards certain topics.

In the case of Mathematics, each of the proposed variables contributes to increase the student´s perception towards this discipline and thus, there is a change of perception when classes are done as workshops, including History of Mathematics.

Regarding the History of Mathematics in the teaching process, it is possible to mention a quote by Bell (1985).... *No subject loses more than when it is divorced from its history, as it happens in Mathematics*. The former leads us to think about the importance of this element in relation to the teaching didactic of this discipline.

Furthermore, the use of simulators has a positive effect in student´s learning and it can be inferred that by using such tools, classes become more attractive.

The same happens for spreadsheet programming, virtual platforms and communities, meaning that when using tools offered by Information Technologies there is a change of the students´ attitude towards this discipline. Besides, if Mathematics History is integrated to the program, the student better understands the importance of the subject in daily life (Bell, 1985; González-Urbaneja, 2004).

These results match the ones stated by Pazos et al. (2001) and Salinas (2003), who claim that virtual communities are spaces of ideas interchange that favors learning; Goldenberg (2003) mentions that CIT can be used in Mathematics to avoid giving a poor impression of this subject. Moursund (2003) maintains that spreadsheet programming offers a fundamental environment for problem solving and the representation of numeric data. Also, the results match the ones by Fauvel (1991) and Clinard (1993) and Furinghetti (1997), who support the argument of including Mathematics History as an important component in the T-L-E processes, since it helps increase the appreciation of the importance, usefulness and value of Mathematics.

In relation to the afore-mentioned, it is necessary for the teacher of this subject to include in its curricula, topics and activities using the CIT and including the variables from the techno-pedagogic model, in such a way that learning is improved but above all that it is oriented to change the student´s perception towards Mathematics in order to attain a favorable perception towards Financial Mathematics.

6. *Proposal of the techno-pedagogic model*

Next there is a step by step description of the techno-pedagogic model proposal for the teaching process of Financial Mathematics, applicable in college education scenarios. It is relevant to highlight that this subject is taken for the study plan of college careers from the economic-administrative area because of its connotation and application field.

6.1. Development of traditional class

In a traditional Mathematics teaching session, each of the topics that are part of the subject´s curricula are approached. To explain a class taught in the traditional way, we will take as example the topic of arithmetic gradient *(G_a)* and geometric gradient (G_g) to solve a hypothetical case. First, the teacher presents the formulas regularly used for the development of the intended case that will be solved, trying to explain its composition and the meaning of the elements that make up each theorem.

Arithmetic gradient	
To know current value	To know future value
$VA=\left[\left(Rp_1+\frac{G_a}{i/m}\right)\left[\frac{(1+i/m)^n-1}{i/m}\right]-\frac{n*G_a}{i/m}\right](1+i/m)^{-n}$ (1)	$M_{ga}=(Rp_1+\frac{G_a}{i/m})\left[\frac{(1+i/m)^n-1}{i/m}\right]-\frac{n*G_a}{i/m}$ (2)
Geometric gradient	

$$Si \quad (1+ i/m)^1 Gg: \quad Mg_g = R_1\left[\frac{(1+ i/m)^n - (1+Gg)^n}{i/m - Gg}\right], \quad A = R_1\left[\frac{(1+ i/m)^n - (Gg)^n}{(1+ i/m)^n(1+ i/m - Gg)}\right]$$

$$Si \quad (1+ i/m) = Gg \qquad Mg_g = nR_1(1+ i/m)^{n-1} \qquad A = \frac{nR_1}{1+ i/m}$$

(3)

To know the current and future value, the formulas to be used are different, that is, they depend on the progression reason (G_g) matching the factor $(1+ i/m)$.

Where: ***M_{ga} or VF_{ga}:*** Future value or amount of a series of fees with arithmetic or geometric gradient (of the sum of payments); ***M_{gg} or VF_{gg}:*** Future value or amount of a series of fees with arithmetic or geometric gradient (of the sum of payments); ***A or Rp:*** Annuity or periodic rent (even fee or annuity); ***VA_{ga}:*** Current value of the set of periodic rents; ***i:*** nominal interest rate; ***m:*** Capitalization (for its type, monthly, bimonthly, etc. the rate is divided: an example of it, if there is a monthly capitalization rate of 12 % = (12 %/12); ***n:*** Time; ***G_a=*** is the arithmetic gradient*;* ***G_g=*** is the geometric gradient*;* ***Rp_1=*** Annuity or periodic rent number 1.

Once the professor explains the theorem and its application fields, exercises are done in the traditional Mathematics teaching class. As an example of this, let´s assume that it is required to know the amount that has been accumulated in an investment fund established by 10 monthly deposits that grow at a G_g*: 5.5 %* rate, being the amount of the first deposit $1,000.00 with a 12 % monthly capitalization rate. From the formula:

$$Si \quad (1+ i/m)^1 Gg: \quad Mg_g = Rp_1(1+ i/m)\left[\frac{(1+ i/m)^n - (1+Gg)^n}{i/m - Gg}\right]$$

Where: Rp_1 = $1,000.00; G_g = 5.5 %; n = number of fees 10; i/m = .20/12 =0.01666667 which is the same as 1.6666667% (capitalization rate in m periods per year).

It is solved as:

$$Mg_g = 1{,}000.00_1(1+.20/12)\left[\frac{(1+.20/12)^{10} - (1+0.055)^{10}}{20/12 - 0.055}\right] \quad Mg_g = 1{,}000.00_1(1.01666667)\left[\frac{(1.17973879) - 1.70814446}{0.01666667 - 0.055}\right]$$

$$Mg_g = 1{,}000.00_1(1.01666667)\left[\frac{-0.52840567}{-0.03833333}\right] \quad Mg_g = 1{,}000.00_1(1.01666667)\left[13.7844969\right]$$

$$Mg_g = 1{,}000.00_1(14.0142386) \quad Mg_g = \$14{,}014.24$$

If the fees where past due with *Gg*, it is derived from the formula:

$$\textbf{Si} \quad (1+ i/m)^1 Gg: \quad Mg_g = Rp_1(1+ i/m)\left[\frac{(1+ i/m)^n - (1+Gg)^n}{i/m - Gg}\right] \quad \text{Then:} \quad Mg_g = Rp_1\left[\frac{(1+ i/m)^n - (1+Gg)^n}{i/m - Gg}\right]$$

Same data: Rp_1 = $1,000.00; G_g = 5.5 %; n = number of fees 10; i/m = .20/12 =0.01666667 (capitalization rate in m periods per year).

$$Mg_g = 1{,}000.00_1 * \left[\frac{(1+.20/12)^{10} - (1+0.055)^{10}}{20/12 - 0.055}\right] \quad Mg_g = 1{,}000.00_1 * \left[\frac{(1.17973879) - 1.70814446}{0.01666667 - 0.055}\right]$$

$$Mg_g = 1{,}000.00 * \left[\frac{-0.52840567}{-0.03833333}\right] \quad Mg_g = 1{,}000.00\left[13.7844969\right] \quad Mg_g = \$13{,}784.50$$

In the same class dynamic, it is calculated inversely, that is, the exercise about the current value of *Rp* is done, so that in order to obtain an amount of $14,014.24 what must be the amount of

the first of 10 periodic fees (n=10) that increase by 5.5 % with an interest rate of 20 % monthly capitalization?: Now it is solved in its format of prepaid and past due fees, from the formula:

$$Si \quad (1+ i/m)^1 Gg: \quad Mg_g = Rp_1(1+ i/m)\left[\frac{(1+ i/m)^n - (1+Gg)^n}{i/m - Gg}\right]$$

Prepaid are calculated

$$\$14,014.24 = Rp_1(1+ .20/12)\left[\frac{(1+ .20/12)^{10} - (1+0.055)^{10}}{20/12 - 0.055}\right] \qquad \$14,014.24 = Rp_1(1.0166667)\left[\frac{(1.0166667)^{10} - (1+0.055)^{10}}{.0166667 - 0.055}\right]$$

$$\$14,014.24 = Rp_1(1.01666667)\left[\frac{-0.52840567}{-0.03833333}\right] \qquad \$14,014.24 = Rp_1(1.01666667)\left[13.7844969\right]$$

$$Rp_1 g = \frac{\$14,014.24}{14.0142386} \qquad Rp_1 = \$1,000.00$$

Past due are calculated:

In order to obtain an amount of $13,784.50, what must be the amount of the first of 10 periodic fees (n=10) that increase by 5.5 % with an interest rate of 20% monthly capitalization?:

$$\$13,784.50 = Rp_1 * \left[\frac{(1+ .20/12)^{10} - (1+0.055)^{10}}{20/12 - 0.055}\right] \qquad \$13,784.50 = Rp_1 * \left[\frac{(1.17973879) - 1.70814446}{0.01666667 - 0.055}\right]$$

$$\$13,784.50 = Rp\left[13.7844969\right] \qquad Rp1 = \frac{\$13,784.50}{13.7844969} \qquad Rp_1 = \$1,000.00$$

If we now want to know the term, we need to solve for it in the formula from the amount of a series of prepaid fees with geometric gradient:

$$Mg_g = Rp_1(1+ i/m)\,\frac{(1+ i/m)^n - (1+Gg)^n}{i/m - Gg} \qquad So, we\ have\ what \quad \frac{Mg_g}{Rp_1(1+ i/m)} = \frac{(1+ i/m)^x - (1+G_g)^x}{i/m - G_g}$$

The denominator of the right set goes multiplying to the left, thus obtaining:

$$\frac{Mg_g}{Rp_1(1+ i/m)} * (i/m - G_g) = \left[(1+ i/m)^x - (1+G_g)^x\right]$$

The gradient goes as sum to the left, now we need to fulfill the following equation:

$$(1+G_g)^x - (1+ i/m)^x - \left[\frac{Mg_g}{Rp_1(1+ i/m)} * (i/m - G_g)\right] = 0$$

In summary, we might think in the traditional system this procedure seems tedious or a nuisance for the student, which creates an apparent rejection towards the teaching-learning process. Also, it is very common for the student not to memorize the steps of each formula and that causes him/her to forget them, hence the proposed techno-pedagogic model, which measured the perception of 52 students, is perceived the students as highly accepted for their college training process, but how is the techno-pedagogic model visualized for the teaching of Financial Mathematics?

We must remember that the variables from the EAPHMF scale, which are: contents of Mathematics history, workshop class, use of spreadsheet, design of financial simulators and virtual learning communities. From these variables, the course is planned contextualizing first the topics of Financial Mathematics, a brief outline of its history and how these topics were gestated. The class is organized in teams of three or four participants, encouraging teamwork in each of them.

It is proposed that in the spreadsheet each of the mathematical theorems are programmed. Its transformation to programming is done at all times by the student aided by the teacher. Programming goes from basic Excel to advanced Excel and/or in Visual Basic, or in any other program that allows programming for the development of calculations and interacting in virtual platforms with other participants from other parts of local and/or global context. Each exercise is contextualized in its current reality, meaning that scenarios are created as they happen in daily life, attempting to adapt each topic to a requirement or specific activity of people or company´s financial activities.

6.2. Session with the Techno-pedagogic model for the teaching of Financial Mathematics

Next there is a sequence of the process using the same data: *Rp1* = $1,000.00; Gg = 5.5 %; n = number of fees 10; *i/m* = .20/12 =0.01666667 (capitalization rate in *m* periods per year). Then, we proceed to programming and for that, the templates must be designed considering all the variables of the formula used for the calculations, then the exit sell needs to be programmed in Excel, an example is: *Mgg* past due yearly fee =(F4)*(((1+F7)^F6)-(1+F5) ^F6)/(F7-F5) and *Mgg* prepaid yearly fee =(F4)*(1+F7)*(((1+F7)^F6)-(1+F5) ^F6)/(F7-F5).

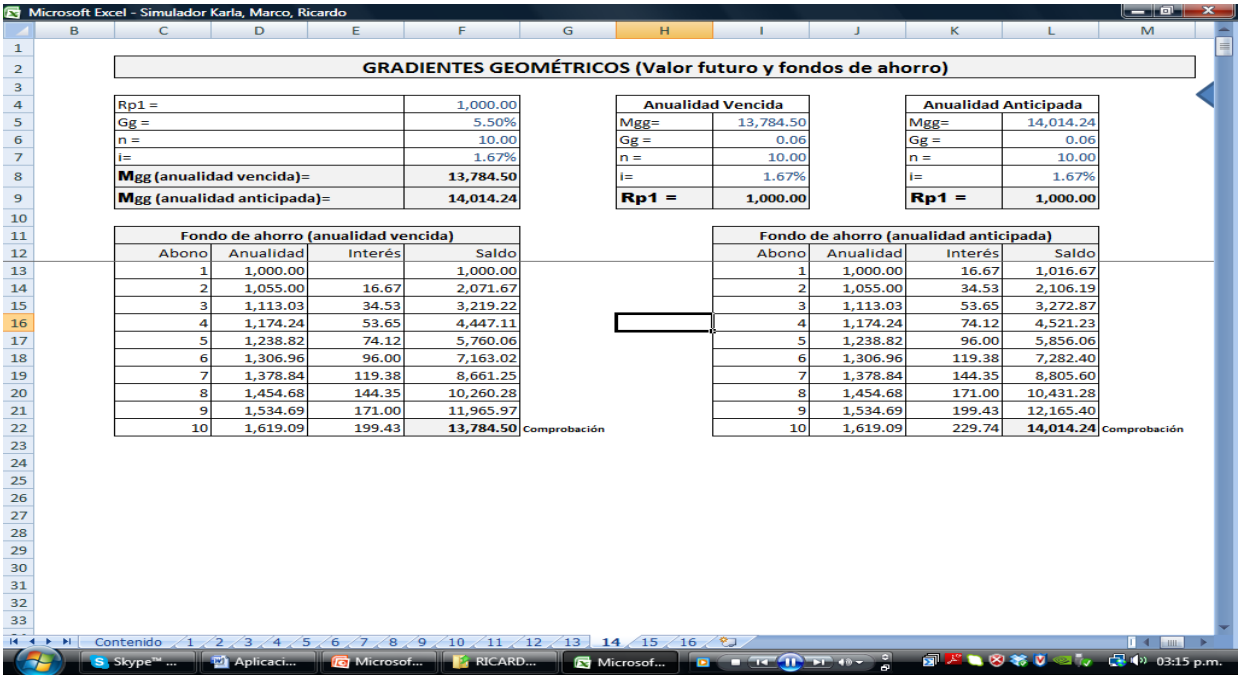

Fig. 2. Excel spreadsheet for gradients
Source: own

Other example of Excel programming with a higher complexity level would be as follows:

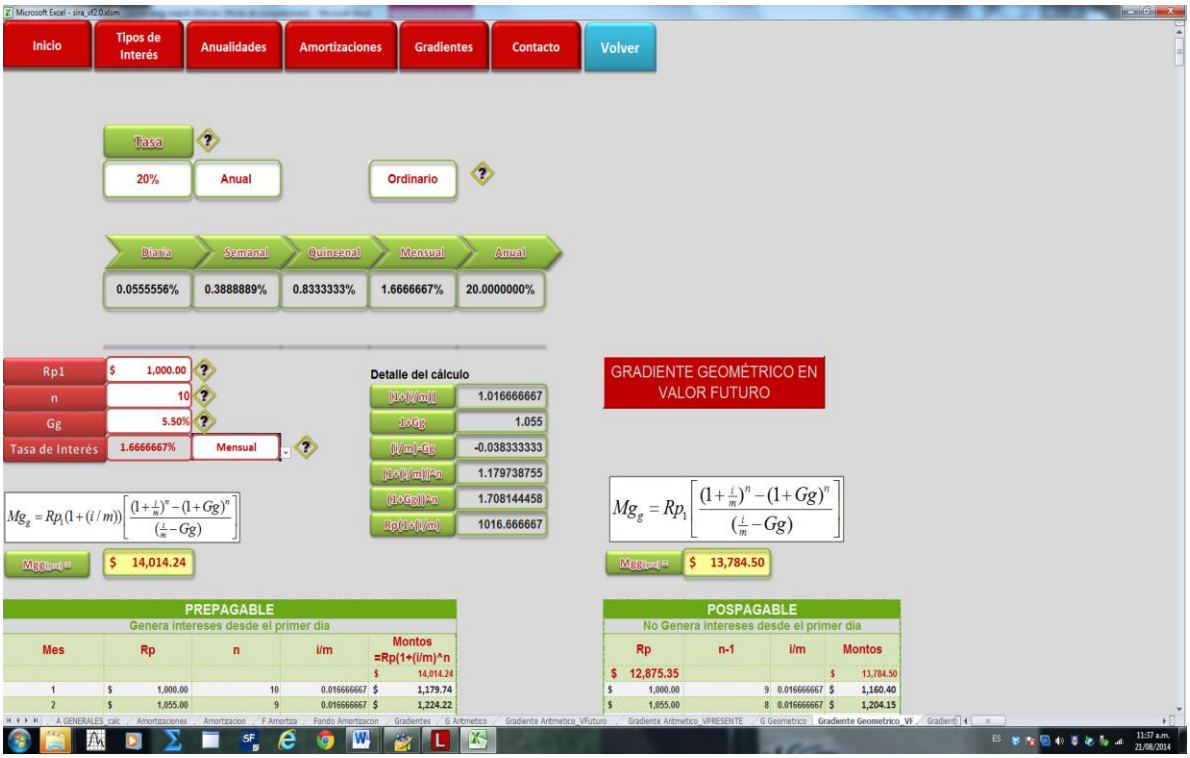

Fig. 3. Excel spreadsheet for gradients
Source: own

This sort of templates vary depending on the design that each student gives to the simulator, in the same template a series of icons are imbedded and when clicked an instruction is opened for the filling of data. For instance, in the simulator shown on Figure 3, the icons appear and when they are clicked, a menu is opened to use the tool.

Guide for the use of Financial Simulator.

1. Use the Arithmetic Gradient formula for Future Value.
2. Introduce in the box "Rate" the given interest rate.
3. Choose if the rate is yearly, monthly.
4. Choose the type of interest, if it is ordinary or exact (remember that for an exact calculation there are 365 days and for an ordinary calculation, 360 days)
5. If you click on the symbol a help message will be opened to present which data must be introduced in each field.

Other simulator model made in Java programming by the students who have taken the Financial Mathematics subject with the use of the techno-pedagogic model is shown next:

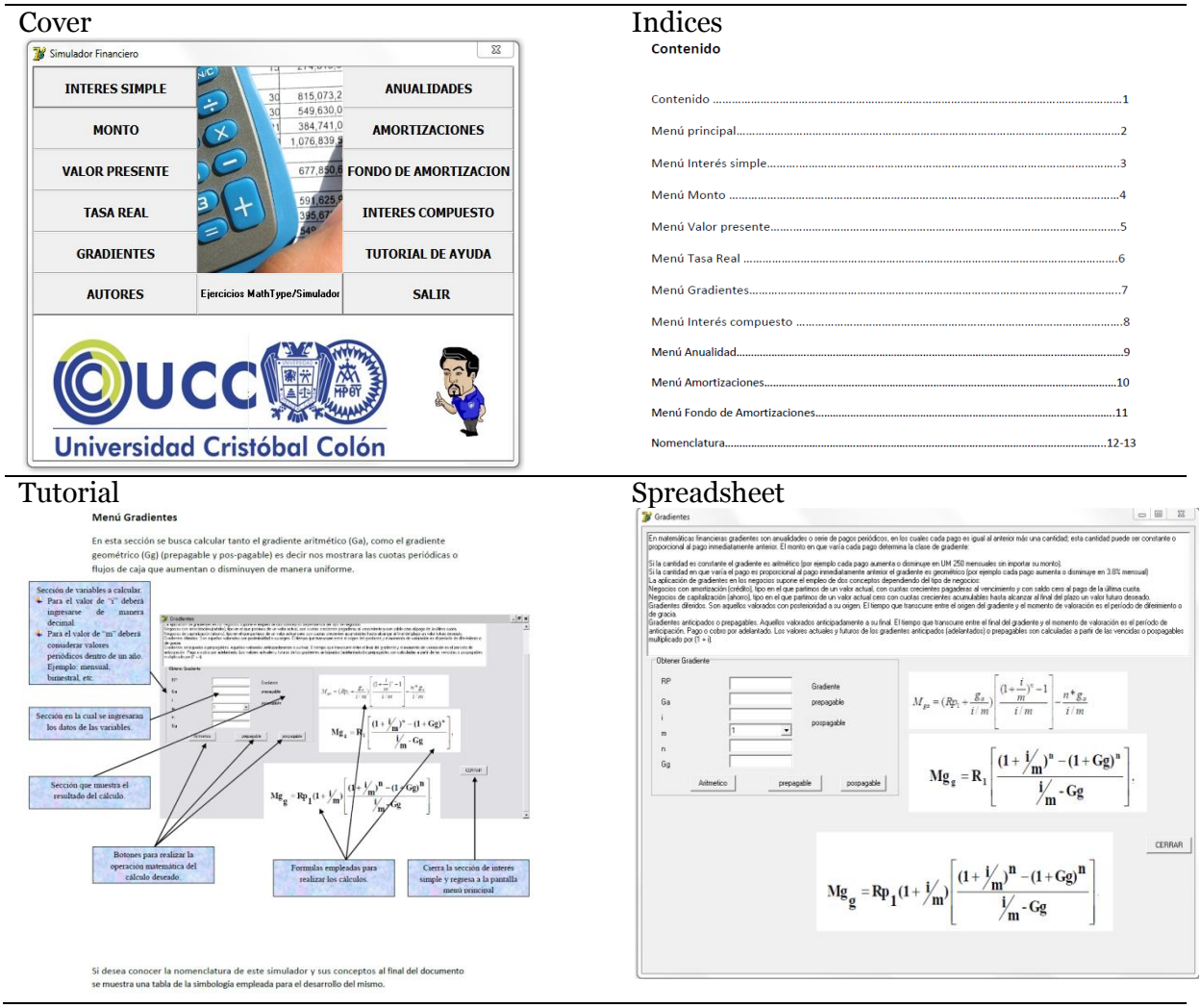

Fig. 4. Financial simulator in Java programming (own)

Final considerations

The field of Mathematics is very wide, in fact, it could be said that it is present in every activity of human beings, its use and application in daily life has aided scientific and technological development. Likewise, it has also represented an obstacle for a large part of the population during their academic training, which goes from basic education to graduate or post-graduate levels, since its apparent rejection can be said to be due to being poorly understood by those who are students at the time.

Regarding Mathematics, some reflections can be taken from an interesting interview done by Villafrades (2016) to professor Dúwamg Alexis Prada M., a known figure in the teaching of Mathematics, specifically in the subjects of algebra, differential calculus, integral calculus, multivariate calculus, differential equations, analytic geometry, geometry and trigonometry, Mathematics applied to microbiology, Mathematics for biologists, topology for mathematicians.

For professor Dúwamg, Mathematics is a beautiful language that starts from the abstract to make inferences in several branches of knowledge, thus, allowing the approach of study phenomena by using models and theorems, and therefore, contributing to the explanations required from all society activities.

This reflection is relevant when we speak about the importance of being able to contextualize each of the models used for the teaching of Mathematics, because beyond presenting it in its abstract form, it is advisable to relate it to real and tangible cases that are present in the context, searching for a logical explanation.

The knowledge disciplines of Economy and Finances are, among others, a very demanding field of Mathematics application, hence the importance of understanding that Mathematics are present in daily life, in everything we see around us, it will always be present at a time or activity when we need a calculation, even if we do not use complex formulas or specific algebra equations.

"In the language of mathematics, equations are like poetry: They state truths with a unique precision, convey volumes of information in rather brief terms, and often are difficult for the uninitiated to comprehend. And just as conventional poetry helps us to see deep within ourselves, mathematical poetry helps us to see far beyond ourselves-if not all the way up to heaven, then at least out to the brink of the visible universe."

Michael Guillen – Five equations that changed the world: The power and poetry of Mathematics

7. Acknowledgement

Our eternal gratitude goes to Jésica J. Ramos-Hernández for all her support. To UCC Business School for its support to carry out this work and finally our gratitude goes to the reviewers for all suggestions to improve the paper.

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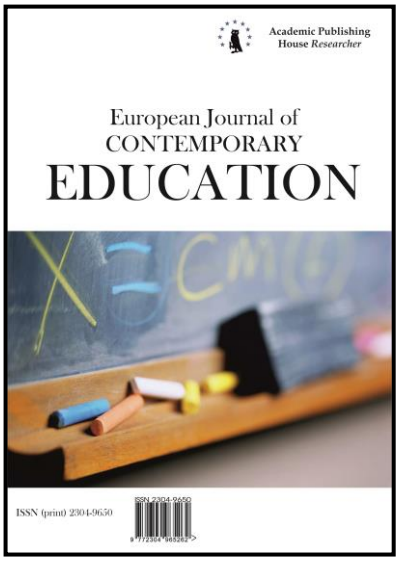
Published in the Slovak Republic
European Journal of Contemporary Education
E-ISSN 2305-6746
2018, 7(3): 485-497
DOI: 10.13187/ejced.2018.3.485
www.ejournal1.com



Analysis of Scientific and Educational Space of the Arctic Zone of the Russian Federation and its Contribution to Social and Economic Development

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Abstract

Strategic documents on Russia's development define a transition to a knowledge economy and balanced spatial development, based on innovation and highly skilled human resources. At the present stage of the world economy development, various forms of ties in the scientific, educational, cultural and production spheres that form the scientific and educational space of the territory make a significant economic effect on the restoration and formation of the intellectual potential of the regions. The article describes the scientific and educational space of the Arctic zone of Russia. Specific examples show that in the subjects of the Russian Federation, science and education are unevenly developed. Formation of the scientific and educational space in the Russian Arctic continues. The analysis of this process is of great scientific and practical interest. The meaning of the study is to draw the attention of research organizations and industrial enterprises located both in the Russian Arctic and outside it to the possibility of common use of human, organizational and technical resources within clusters and other forms of interaction. The results of this study may be used by scientific and educational organizations, enterprises of the real sector of the economy, federal and regional executive authorities of the Arctic for the management solutions of the scientific and educational process, training personnel for the real sector of the economy, monitoring the current and prospective staffing needs of the Russian Arctic territories.

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Keywords: scientific and educational space, the Arctic zone of the Russian Federation, development strategy, innovations.

1. Introduction

Throughout the history of mankind, knowledge has been one of the factors of the economic development. The availability of qualifying resources is considered when choosing the location of enterprises in most sectors of the economy. New means of processing, transmitting and delivering information, communication networks and distance education have made procedures that seemed revolutionary 20 - 30 years ago routines. The terms "knowledge economy", "innovation economy", "knowledge society" and "information society" are used to determine the economy with a decisive role of knowledge and the introduction of research results is a source of social and economic development and technological progress.

In the Concept of Social and Economic Development of the Russian Federation for the period up to 2020, the transition to an innovative economic development and balanced spatial development is defined as a target. Intellectual potential is among the key factors of the transition: "The formation of an innovative economy means the transformation of the intellect, the creative potential of a man into the leading factor of economic growth and national competitiveness" (Koncepciya, … 2008). At the moment, Russia at the beginning of the way to organizing the system that is supposed to stimulate the innovative development of the country. Education and organizing scientific research is of decisive importance. Meanwhile, Russia accounts for less than 2 % of global spending on research and development (R&D) at purchasing power parity. In terms of R&D expenditures, Russia spends 17 times less than the US, 12 times less than the EU, 6 times less than China, and 1.5 less than India. In terms of public R&D expenditures per capita (US $ 86), Russia spends 4–5 times less compare to the leaders, and as for private expenses ($ 40), it is 15–20 times. The effectiveness of Russian research organizations is much lower than in the leading countries (the US, Japan, China and the Republic of Korea). The share of innovative products in the total output is 8–9 %. The weak interaction of innovative development and research sector and the real sector of the economy remains. Almost no transfer of knowledge and technologies between the defense-industrial and civil sectors of the economy is observed. This hinders the use of high technology products of dual purpose (Leonidova, 2010). The accumulated organizational, financial and economic problems require an immediate solution.

2. Relevance

The Arctic issues of the first third of the 21st century remain in demand in the scientific, economic, social, humanitarian and political spheres. The Arctic is facing important changes that are global, long-term and multidirectional. They are developing against the backdrop of a lack of our knowledge of their nature and consequences. Is is especially true for the climate change and its resulting threat of the spatial development transformation of the vast Arctic macro-region.

Russia has made a significant contribution to the scientifically-based development of natural resources in the Far North and the Arctic. In the USSR, the development of the Arctic territories was started 30–40 years earlier than in other circumpolar countries. The expeditions organized in the USSR contributed to the solving the fundamental development tasks of the Earth and were used for the scientific and operational support of economic and defense activities in the Arctic.

After the collapse of the Soviet Union, due to the reduction of funding, staff shortages and depreciation of production funds, Russia lost the primacy in research made in the interests of social and economic development of the Far North. Expedition projects were frozen, funding for exploration and mining programs was cut, the renewal of the research fleet was stopped for a long time, and the infrastructure of scientific centers and weather stations – the key links in the weather monitoring in the Arctic – declined (Zaikov et al., 2016).

Restoration of the social and economic potential of the Arctic is the main goal of the Russian Arctic strategy adopted in 2013 (Strategiya razvitiya, 2013). The document is focused on increasing and concentrating competitive scientific knowledge, investments and production potential in the most promising areas, in centers that form the focus of social and economic efficiency in the Arctic zone of the Russian Federation (hereinafter – the Arctic zone, AZRF). The innovative scenario of the Strategy presupposes the modernization of the scientific and technical institutional environment, the development of knowledge-intensive infrastructure, the creation of production

for deep processing of natural resources aimed at obtaining products with high added value. According to this scenario, the pace of development of the Russian Arctic is supposed to be higher than the national average due to the megaprojects in the resource use, transport and communication spheres and high-skilled Arctic labor (Zajkov et al., 2017). It could be said that effective development of the Arctic zone of Russia is possible due to the integration of educational, scientific, technical and technological potentials into a single scientific and educational space (hereinafter – "SES").

3. Materials and methods

The methodological bases of the study are the works of Russian and foreign scientists in the field of study of the features of the territorial organization of science and education in Russia and the materials of surveys of heads of enterprises and educational institutions in the subjects of the Russian Arctic.

As a scientific term and an objective entity, space is an object of study for natural, humanitarian, economic and social sciences. The term "space" is associated with the definition of "territory". "The general scientific interpretation of the concept of "space"... is formulated within the framework of philosophy ... Space ... is understood as the universal form of being, inseparable from ... time ..." (Chistobaev, Gladkij, 2003). Theoretical aspects of spatial development are considered in the writings of British economists A. Smith and D. Riccardo. The scientific foundations of the spatial organization of the economy, the principles and factors of the location of productive forces are discussed by I. Thünen, A. Weber, F. Perroux, A.G. Granberg and P.A. Minaker. A significant stage in the study of spatial development was the work on determining the competitiveness factors of the countries by M. Porter, published at the turn of the 20th – 21st centuries. A definition by A.I. Chistobayev: "The dynamic social sphere, or socio-geographical space, considered as a time-space combination of social objects, phenomena and processes in conjunction with environment is especially distinguished ... So, the concept of "geographic space" integrates the territory and its social and economic content" (Mashbic, 1998). Geographical space is most often treated as a philosophic concept, as an objective, a universal and cognitive form of existence of geographic formations and objects within the geosphere (Chistobaev, Gladkij, 2003).

It should be noted that the universally recognized definition of SES does not exist. Such kind of issues are often addressed at the level of interstate and interregional categories. V.F. Baynev, V.A. Danilov, V.K. Shapovalov and D.A. Yagofarov prioritized the theoretical and applied aspects of the educational space. Its tasks are the formation and transfer of primary knowledge and the formation of a harmoniously developed personality. "In fact, the educational space is all the physical and legal persons of the region, the whole region, but in a certain aspect – in relation to education" (Novikov, 2000).

In the Russian scientific literature, the tasks of the scientific space include (Leonidova, 2010):

- fundamental and applied scientific research;
- use and evaluation of scientific knowledge for the purpose of social and economic development and improving the safety of the population;
- coordination of research programs for the development of a unified educational and scientific policy;
- promotion of knowledge as a method of solving global social, economic and environmental problems.

The scientific and educational spaces are determined by geographic, natural and climatic features of the territory, depending on the level of their development, the composition of the population, its educational needs, culture, traditions and income level. Both types of spaces function at different levels: from local (municipal) to global and transboundary levels and have social functions. The degree of formation of these spaces is used to assess the state and trends of competitive development of countries and their regions (Leonidova, 2010).

The authors separate "educational space", "scientific space" and "scientific and educational space" for the purposes of the study. In relation to the theme of the article, different aspects depend on the perspective and disciplines they are subjected to. We consider SES from the position of its significance for the sustainable social and economic development of the Russian Arctic.

SES is a multi-level system. Levels are defined by the semantic context and the identification of elements related to each other, and include (Leonidova, 2010):

- educational bodies: general education, secondary vocational education (SVE), and higher professional education (HPE);
- research institutions;
- state bodies for the educational and scientific policy;
- enterprises – research customers, interacting with the SVE and HPE institutions, providing opportunities for internships and employment of graduates;
- innovation institutions (technology parks, business incubators, and implementation centers);
- cultural and educational institutions (museums and libraries).

The components of SES are characterized by specific approaches to training, scientific research, use of immovables and equipment localized on a certain territory. Such an understanding is primary and simplistic, because at the same time, the degree of interconnectedness of the elements and their cooperative effects are not determined. The elements are united by the commonality of their location. Transition to a higher level of SES research makes it important to analyze and consider specific factors, links and mechanisms of interaction between subjects that cause a synergistic effect from the development of the scientific and educational space. This level of development demonstrates the existence of clusters.

The main principles of SES are (Leonidova, 2010):

- coherence of actions of educational institutions of all levels located in the region;
- the continuity of education, ensuring the coordination of forms, types and technologies of instruction;
- a combination of theoretical and applied training (the applied bachelor study programs), focused on the current and future needs of the regional development;
- interrelation of educational and methodological support of training and research developments;
- the use of corporate principles in the regional educational space.

We define SES a highly organized type of environment consisting of interrelated components of the educational and scientific spaces, serving their infrastructure and elements of the production sector involved in the science and education, and using its results in the interests of sustainable social and economic development of a particular territory.

The study of SES in the Russian Arctic was carried out by the North (Arctic) Federal University named after M.V. Lomonosov (NArFU) in 2015–2016. The purpose of the study was to analyze the scientific and educational spaces in the Russian Arctic and to contribute to the information-analytical and methodological support of decision-making for the development of the state policy of Russia in the field of training and research activity in the Arctic.

In the study, we used the structural and functional approach and considered SES a multi-level system dependent on social, economic and demographic processes in the Arctic on national and international levels. In our opinion, the dependence is mutual.

The study of the SES in the Russian Arctic was carried out through the SES monitoring in the subjects of Russia that have a legal status of the land areas of the Arctic Zone of the Russian Federation in the Decree of the President of Russia (O suhoputnyh territoriyah, 2014). The study involved 203 educational institutions. 30 of them have Arctic study programs. Among these 30 institutions: 5 universities and 1 branch university are located on the territory of the Russian Arctic. The target group of the study: students of the Arctic graduate and undergraduate programs at the universities located in the Russian Arctic: the NArFU and the Northern State Medical University (NSMU, Arkhangelsk), the Murmansk Arctic State University (MASU) and the Murmansk State Technical University (MSTU). 3000 respondents participated in the questionnaire: 1500 1-year students and 1500 4–5-year bachelor or master students. The goal of the interviewers was to find the representatives for the target group, to invite them to participate in the survey, to complete it and to collect results.

To reduce the intersubjectivity in developing recommendations for executive bodies on scientific and personnel policy in the Russian Arctic in 2015–2016, several roundtables and seminars had been held within the framework of international and All-Russian scientific conferences in the NArFU: “Monitoring and Evaluation of the Development of the Arctic Territories”, “Training for the Arctic: From Problems to Solutions”, “The Arctic – National

Megaproject: manpower and scientific support", and international scientific forum "The Arctic: Present and Future – 2016".

4. Discussion

Analyzing the SES in the subjects of the Russian Arctic, we can conclude that it is not homogeneous. This is determined by different number of universities, scientific institutions, centers of applied research and consumers of their services. The Russian Arctic includes both entire subjects of the Russian Federation and their parts. This determines the localization of universities, scientific research and R&D, application of management technics, financing and other forms of state support.

Figure 1 shows the number of educational institutions with the Arctic study or research programs. Figure 2 shows Russian universities with the Arctic study programs.

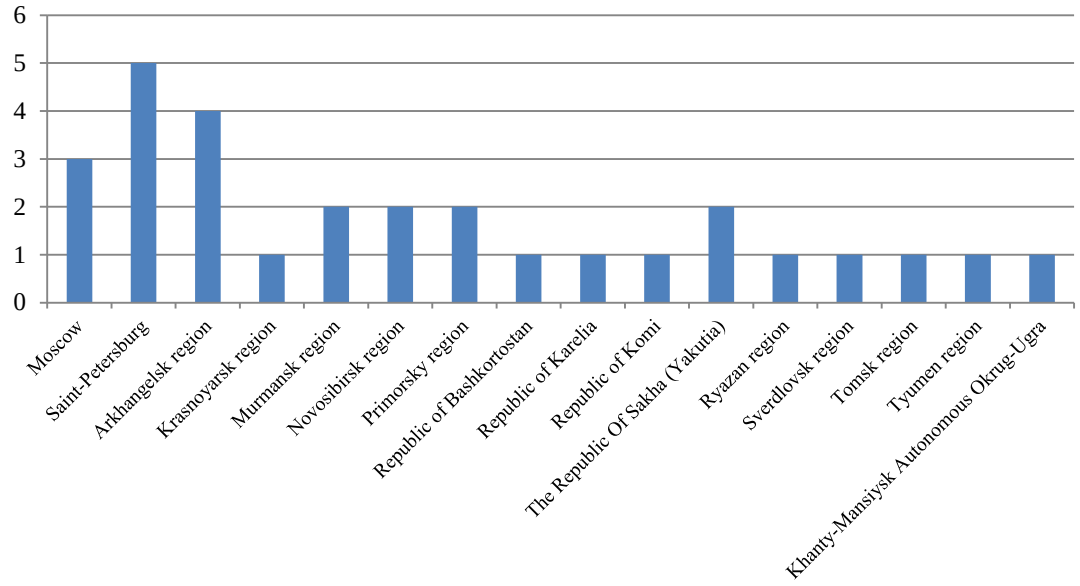

Fig. 1. The number of educational institutions with the Arctic study programs in the subjects of the Russian Federation

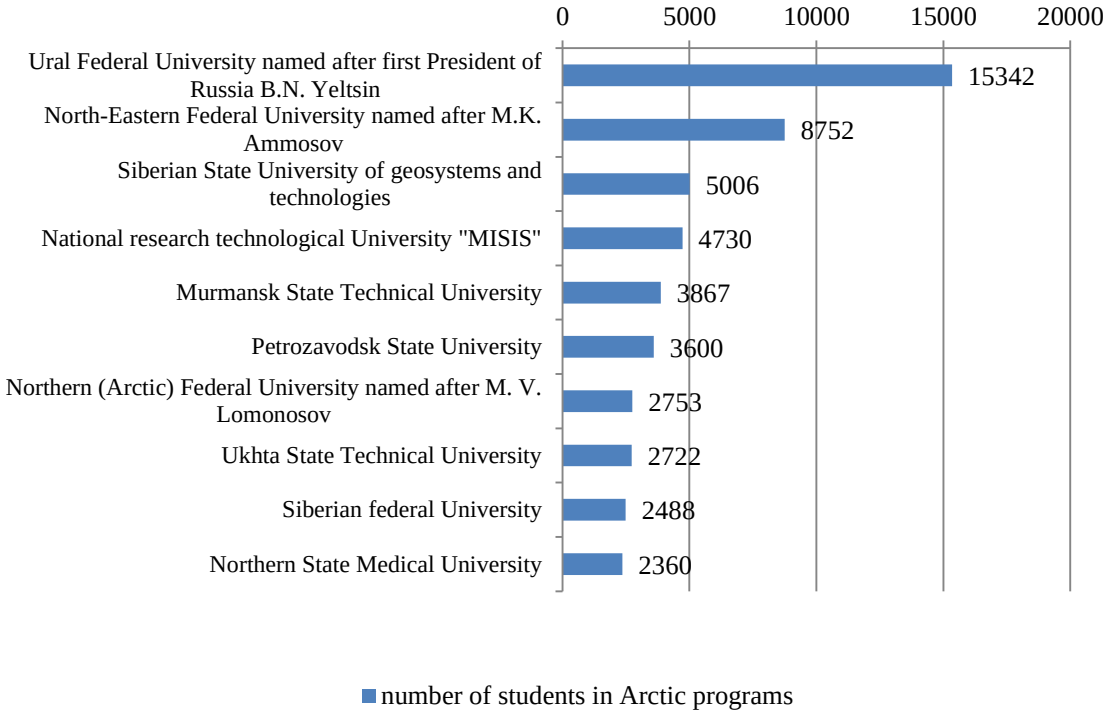

Fig. 2. Russian universities with the Arctic study programs

The total number of students trained within the Arctic study programs in educational institutions of Russia is 61 424 people. 54% are trained on a budgetary basis and 46% on a full-paid basis (See Figure 3).

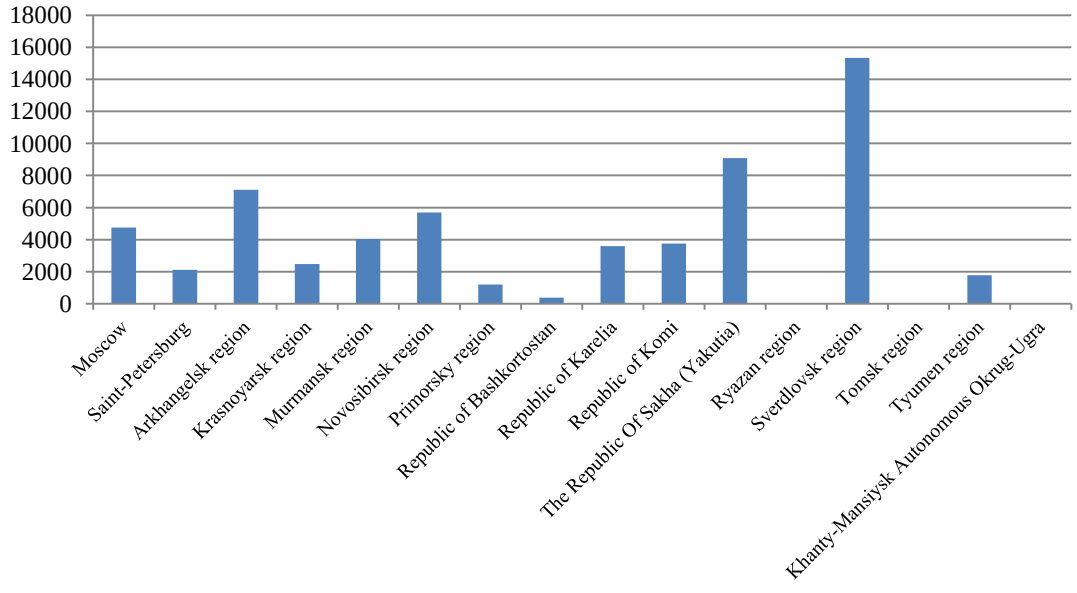

Fig. 3. The number of students trained within the Arctic study programs in the subjects of the Russian Federation

The number of degree programs with the Arctic components is 227 (Figure 4).

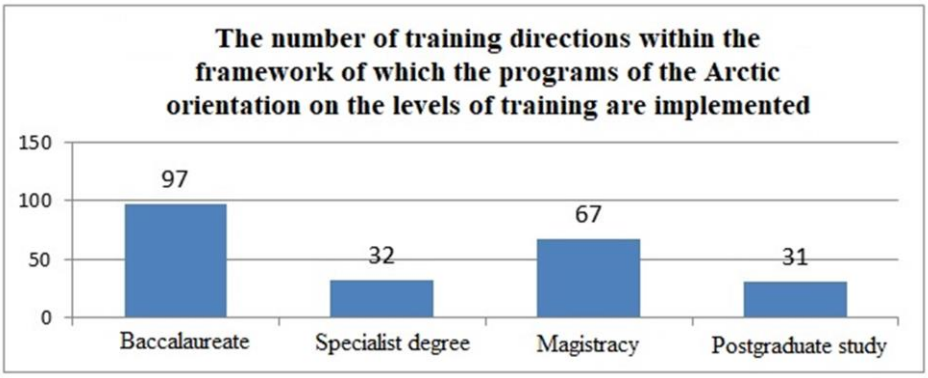

Fig. 4. The number of degree programs with the Arctic components

In the Figure 4, bachelor's degree is the level with the maximum number of the Arctic programs and disciplines compare to the other training levels and the maximum number of students. The bachelor's degree programs are related to construction (4,521 students), oil and gas business (3,700 students), electricity (2095 students), metallurgy (2028 students), applied hydrometeorology (1342 students), pedagogics and jurisprudence (less than 1000 students). If we apply the same criterion to the specialist degree programs, we get the following list of programs with the Arctic component: mining (4977 students), applied geodesy (2858 students), medicine and pediatrics (2342 and 988 students respectively), and navigation (946 students). Master's degree programs with the Arctic component: metallurgy (805 students), oil and gas business (554 students), construction (196 students), ecology and environmental management (161 students), IT (153 students), and economics (128 students). Postgraduate courses with the Arctic focus: geosciences, biological sciences, medicine, geology, exploration and mining, shipbuilding and water transport. They are distinguished by the largest number of profiles and the number of students.

The monitoring showed that only 3.5 % of students within the Arctic study programs were trained under the target admission contracts, 4.3 % of students studied under target enrollment contracts in the universities located in the Russian Arctic. 3.2 % were trained under such admission contracts at the universities located outside the Russian Arctic. Low rates are usually perceived as an alarm. They indicate that educational institutions have little interaction with enterprises on target admission, incl. applied scientific, graduate and undergraduate programs.

According to official statistics, the number of universities, students, scientific institutions and employees differ in the subjects of the Russian Arctic (Table 1).

Table 1. Number of universities and scientific organizations and their quantity in the subjects of the Russian Arctic (incl. the subjects located outside the Russian Arctic)

Subject of the Russian Federation	MO	NAO	ChAO	YaNAO	AO	KK	RS(Ya)	KR
Number of higher educational institutions	2	0	0	0	3	10	7	3
Number of branch higher educational institutions	16	0	2	16	8	29	18	11
Number of graduate and undergraduate students	20,4	0	0,5	5,6	25,7	96,1	30,4	24,5
R&D institutions	29	4	1	4	28	52	24	24
Number of staff engaged in R&D	2342	62	24	109	1045	7543	2250	1981

Note: MO – the Murmansk oblast, AO – the Arkhangelsk oblast, KR – the Komi Republic, RS(Ya) – the Republic of Sakha (Yakutiya), KK – the Krasnoyarsk krai, NAO – the Nenets Autonomous District, ChAO – the Chukchi Autonomous District, YaNAO – the Yamal-Nenets Autonomous District.

The data in Table 1 proves the absence of higher educational institution in autonomous districts. The Nenets Autonomous District only has a branch institution of the NArFU. Therefore, training "on the ground" in order to meet the needs of local extractive industries is almost absent. In these subjects, a small number of R&D institutions are represented, compare to the other parts of the Arctic zone.

Even more noticeable is the differentiation of the Arctic territories in terms of the SES quantitative parameters. Table 2 presents calculated density indices of the scientific and educational space in relation to the area of the Russian Arctic.

Table 2. The density of some of the SES indexes of the subjects of the Russian Federation in relation to the territories of the Russian Arctic

Subject of the Russian Federation	Number of higher educational institutions and their branches per 1000 km²	Number of graduate and undergraduate students per 1000 km²	Number of R&D institutions per 1000 km²	Number of staff engaged in R&D per 1000 km²
The Murmansk oblast	0,138	140,78	0,200	16,16
The Arkhangelsk oblast	0,029	62,21	0,068	2,53
NAO	0,000	0,00	0,023	0,35
ChAO	0,003	0,69	0,001	0,03
YaNAO	0,021	7,28	0,005	0,14
The Krasnoyarsk krai	0,016	40,60	0,022	3,19
The Republic of Sakha (Yakutia)	0,008	9,86	0,008	0,73
The Komi Republic	0,034	58,78	0,058	4,75

Table 2 represents the differentiation level of the scientific and educational space varies hundreds of times. E.g., between the autonomous districts and the Murmansk Oblast. It can be concluded that SES in the subjects of the Russian Arctic exists in the Murmansk oblast, the Arkhangelsk oblast, the Komi Republic and the Sakha (Yakutia). In all autonomous districts, it does not exist.

In order to analyze the next SES level, it is necessary to determine the conditions and mechanisms of interaction between the subjects.

72 % of the Arctic educational programs developed by the SVE and HPE institutions (not discussed here) use the resources of enterprises and other institutions (9%); management practices (73.6 %); and cooperation agreements (23.3 %) (Table 3).

Table 3. The Arctic educational programs in network interaction with companies

University	Number of the Arctic study programs	Number of the Arctic study programs that use the resources of the basic departments	Number of the Arctic study programs that use internship agreements	Number of the Arctic study programs that use other types of contracts and agreements
NArFU	8	13	132	21
Murmansk State Technical University	-	-	35	10
North-East Federal University named after M.K. Ammosov (NEFU)	-	-	139	-
MASU	-	-	-	10

Universities research in the interests of the employer. 45 % of the research topics are in the natural sciences, 41 % – technical, and 14 % – humanities. Nevertheless, a survey of the Russian Arctic enterprises revealed dissatisfaction with the cooperation in the training: enterprises are partners in 22 % of scientific projects (more than 40 % of scientific projects are completed together with the other universities (network projects) and 38 % – with the RAS institutions), 36% of the projects in higher education institutions are linked to megaprojects.

One of the effective forms of interaction between the education and enterprises is a network of applied programs. In the Russian Arctic, 12 universities work on the Arctic programs like that. The other form of interaction is the creation of a basic department. The NArFU branch in Severodvinsk and the enterprises "Arktika" and "Sevmash" organized basis departments of the ship and power engineering and ship life-cycle management with more than 700 students. The Shipyard "Krasnaya Kuznitsa" and "Zvezdochka" Ship Repair Center" support the NArFU Department of Informatics and Computer Technology (246 students). The Arkhangelsk pulp and paper mill (APPM) (Novodvinsk, Arkhangelsk oblast) and Sukhonsky pulp and paper mill (Sokol, Vologda oblast) created a basic department for chemistry students. The program "Technosphere security" is supported by the Federal Fire Service of the Arkhangelsk oblast that contributes to the activities of the Fire and Rescue Department of the university. It seems appropriate to organize the basic departments on hydrometeorology. In addition to the applied aspects of training, various cooperation (incl. expeditions) between the federal university and the territorial agency of Roshydromet could contribute to the assessments of climate change. This will also help the enterprises located both in the Arctic zone and to the south, improve the quality of hydrometeorological support for navigation along the Northern Sea Route, and ensure public safety (Caturov, Klepikov, 2012).

Clusters are the next level of the SES formation. The possibility of scientific and innovative economy based on clusters is proved by the experience of Northern Europe (Severnaya Evropa, 2008). Sweden, Norway and Finland are developing public-private partnerships with industrial enterprises, scientific, educational and public organizations, using international cooperation. The Nordic experience is worthwhile to study and to adopt to the Russian conditions, especially since it is successful (Zajkov et al., 2017). Clusters are being created in various territories of our country. They are based on the integration of educational and scientific organizations, medium and small businesses and resource corporations. Examples are the territorial and branch complex "Export and Import of Education", established in Tomsk in 2014, and a scientific and educational cluster with the participation of the Kazan Federal University.

The state systematically updates the scientific policy in the Arctic zone, bringing it in line with global trends in the development of education and fundamental and applied scientific research. These measures could be used to form clusters on the basis of universities, research centers and on the international basis. The last observation follows from the interdisciplinary nature of scientific research in the Arctic region. Scientific research and applied developments are created in the thematic groups of the University of the Arctic, the International Arctic Science Committee, the Spitsbergen scientific center, the BEAR working groups, the Arctic Council, and the Northern Dimension (Zaikov et al., 2016; The Arctic Council, 2016). Support of scientific and innovative activities is a goal for the RF Government Decree No. 218 April 9, 2010 "On measures of state support for the development of cooperation between Russian educational institutions of higher education, state scientific institutions and organizations implementing complex projects for the creation of high-tech production, within the framework of the subprogram "Institutional development of the research sector" of the state program "Development of science and technology 2013-2020" (Zajkov et al., 2017). Some clusters of the Russian Arctic are presented in Table 4.

Table 4. Some clusters of the Russian Arctic

Cluster	Subject	Key specialization	Number of participants	Number of employees, thousand people	Year	Development level
Innovative territorial forestry cluster of the Arkhangelsk oblast "PomorInnovaLes"	The Arkhangelsk oblast	Forestry and woodworking, pulp and paper industry	31	20110	2014	Medium
Shipbuilding innovative territorial cluster of the Arkhangelsk oblast	The Arkhangelsk oblast	Shipbuilding	23	50417	2012	Medium
Tourist cluster of the Murmansk oblast	The Murmansk oblast	Tourism (entertainment, vacations, arts, sports)	116	-	2015	Initial
Tourist cluster "Severnaya Mozaika"	The Republic of Sakha (Yakutia)	Tourism (entertainment, vacations, arts, sports)	13	88	2011	Initial
Cluster of furniture, woodworking and related industries	The Republic of Sakha (Yakutia)	Forestry and woodworking; pulp and paper production	11	78	2009	Initial

Clusters include educational, scientific organizations and enterprises of the real sector of the economy. The forestry cluster of the Arkhangelsk oblast includes logging, woodworking and pulp-and-paper enterprises of the Arkhangelsk region, OJSC "Northern Maritime Shipping Company", OJSC "Arkhangelsk Commercial Sea Port", JSC "Solombala Machine-Building Plant", the SVE and HPE institutions (NArFU and Novodvinsk industrial school), R&D institutions (The Northern Forestry Research Institute, Arkhangelsk branch of "Roslesinforg" and JSC "Arkhgiprobum"). In 2012 the Arkhangelsk shipbuilding cluster was included in the federal list of innovative territorial clusters. This is the only example among the subjects of the Russian Arctic. The cluster was established in Severodvinsk and is based on the objects of the federal and regional scientific and industrial infrastructure (the SVE and HPE institutions, various research organizations (incl. the RAS institutes), centers for collective use of scientific equipment, and machine-building enterprises). Industrial enterprises design and manufacture devices for oil extraction on the Arctic shelf, testing the energy equipment adapted to the Arctic conditions and used in shipbuilding. Educational and scientific institutions together with the enterprises focus on knowledge-intensive research topics offered by enterprises, develop career-oriented activity, guarantee a workplace for students and graduates during and after training.

Currently, the "Pedagogical Cluster of the Arkhangelsk oblast", the "Social Cluster of the Arkhangelsk oblast" (together with NArFU), and a cluster for the extraction and processing of biological resources in the Arkhangelsk Region are under construction. Professional and educational clusters are considered a form of SES integration. In Yakutia, multidisciplinary research and educational complexes play an important role in the structure of technoparks, venture companies, universities and agencies for coordination of innovation activities. Since 2011, the program "Scientific, Technical and Innovative Development of the Republic of Sakha (Yakutia) 2012-2019" has been in action to form a scientific and innovative system that ensures sustainable social and economic development of the area (Zajkov et al., 2017). The Ministry of Health of Russia had been contributing to the creation of medical clusters in the Russian Arctic since 2015 (Order

No. 844 November 26, 2015 "On the Organization of Work on the Formation of Scientific and Educational Medical Clusters"). E.g., scientific and educational medical clusters of the North-Western Federal District "Severny" (with the NSMU participation) and the Siberian Federal District cluster "Sibirsky". A similar cluster was created on the basis of the Far Eastern Federal District ("Vostochny").

5. Conclusion

We should note the strategic long-term documents for the development of the Arctic zone of the Russian Federation, the Strategy for Scientific and Technological Development of the Russian Federation (approved by the President of Russia in 2016) and etc. define the tasks of transforming science and technology into a driving force of economic development. In other words, it is a transition to a knowledge economy, a balanced spatial development based on innovations, developed infrastructure and highly skilled labor.

The analysis of the monitoring results revealed the inequality of SES in the subjects of the Russian Arctic. It is possible to define the leaders (the Murmansk oblast and the Arkhangelsk oblast) and the outsiders (all autonomous districts) in terms of the SES development. The Arctic educational programs in the subjects of the Russian Arctic function due to the interaction of universities and their branches with companies that operate in the Arctic.

The assessment of the SES of the subjects of the Russian Arctic could be displayed with the help of a strategic management system and the SWOT-analysis in particular. The result of its application for the purposes of our study is presented in Table 5.

Table 5. SWOT- analysis of the SES in the subjects of the Russian Arctic

Competitive advantages (strengths)	Opportunities of the external environment
– special demand for skilled labor at existing enterprises and high-tech industries; – the interest of state authorities in the implementation of cluster policy in the Arctic; – presence of federal universities that develop educational standards and programs with the Arctic focus and a set of the "Arctic" competencies on the territory of the Russian Arctic; – availability of specialized training programs (educational standards); – obtaining the "Arctic" professional competencies and improving skills with the use of distance technologies; – exchange (incl. international) of competencies, technologies, innovations, etc.; – development of a consortium of the Arctic scientific and educational institutions.	– diversification of the Arctic economy of Russia in accordance with the priorities of the world Arctic development; – the emergence of new productions on the territory of the Russian Arctic, incl. high-tech; – involvement of economic entities in the Arctic cluster network; – creation of cluster-forming centers at the universities – integration points of the scientific and educational potential of the region; – development of production sites and business incubators; – additional activation of scientific and educational initiatives with the prospect of creating interregional clusters; – attraction of investments to the region, incl. state programs and public-private partnerships in various sectors; – renovation of the production based on R&D; – infrastructure projects.
Internal constraints (weak sides)	External environmental challenges
– high level of differentiation of SES quantitative characteristics in the subjects of the Russian Arctic;	– deterioration of the foreign policy and economic situation in the Russian Federation;

– professional and qualitative imbalance of supply and demand in the labor market; – lagging behind the training of scientific and pedagogical workers from the requirements of entrepreneurs; – decline in the working-age population; – low activity and interaction of the Arctic scientific research institutions in Russia.	– outflow of highly qualified personnel; – lack of investment in the cluster development of the Arctic; – low innovative activity of business in the areas – parts of the Russian Arctic.

The long-term development of the Russian Arctic continues in the support zones and it will be of a project nature (Pilyasov, 2011). Therefore, it seems advisable to more actively include higher education institutions in the development of equipment and technologies, considering ongoing and promising large-scale mega-projects, as well as plans for the development of support zones and zones of priority state support in the Arctic (Golovchin, Solov'eva, 2012). Today, the universities located in the Russian Arctic keep almost a half of their Arctic programs due to the use of business resources (Petrov et al., 2018).

Cluster policy is of great importance for SES in the Russian Arctic. It is expressed in integration of education, science and industrial enterprises of various profiles: from engineering to the social ones. Such activities are carried out to satisfy the needs of the basic industries in highly qualified personnel capable of ensuring long term sustainable social and economic development of the Russian Arctic, based on innovation and progressive technological solutions (Zamjatina, Piljasov, 2018; Govorova, 2018).

6. Appreciation

We would like to tell a lot of thanks for financial support of our research to Federal Program "Research and development in priority areas of development of the scientific and technological complex of Russia for 2014 – 2020". The agreement № 14.571.21.0011 from 23.10.2017.

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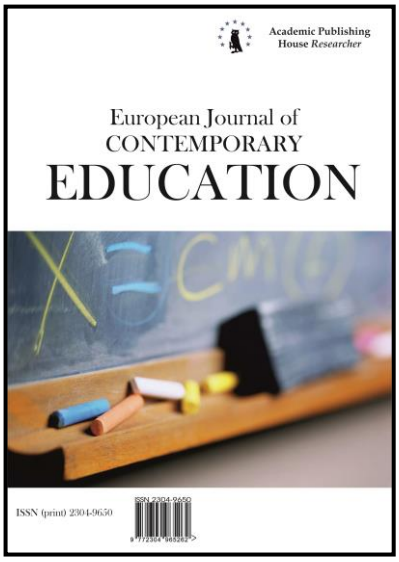
Published in the Slovak Republic
European Journal of Contemporary Education
E-ISSN 2305-6746
2018, 7(3): 498-510
DOI: 10.13187/ejced.2018.3.498
www.ejournal1.com



Scales SACERS: Results of the Study of the Educational Environment of Moscow Schools

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Abstract

The relevance of the study is determined by a need to identify areas for assessment in the quality of education, plus options for evaluating these educational qualities through an assessment of their educational environment. The of the study is to examine options for the application of international SACERS scales. This is in order to assess the educational environment of Russian schools in general, and also to identify the educational environment of schools in the Moscow region. Methods of research: The leading method for the study of this issue is through observation via the use of SACERS scales. Results of the study: The authors of the study have proved - as well as experimentally demonstrated - the potential for using the SACERS scales as a tool for assessing the educational environment of Moscow schools. The features of this specific educational environment were also revealed. Practical significance: The data obtained using the SACERS scales reveal the content characteristics of an educational environment, set the criteria for its development and can become the basis for designing the educational environment of other specific educational organisations. Assessment of the educational environment, using the SACERS scales and its data, can be used in the method of assessment and management of the quality of education.

Keywords: quality of education, educational environment, assessment of the educational environment, SACERS scales.

1. Introduction

The priority and ultimate aim of Russia's state policy in the sphere of education is the provision of, and access to, quality education for all citizens regardless of their place of residence or social status.

In this regard, the question arises: What do we mean by the term ‘quality of education’?

The quality of education is evaluated by assessing a complex series of characteristics which involve the educational activity and training of the trainee, plus measurement of the degree of

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compliance with federal state educational standards, educational standards, federal state requirements and (or) the needs of the individual, or legal entity, in whose interests educational activities are carried out. Also included is the degree of achievement of the planned results educational program (Federal Law…).

Counting the quality of education as an integral characteristic, we are talking, foremost, about the quality of the result, the quality of the conditions, the quality of the process, and the quality of the management of education.

The concept of 'quality of education' involves varied content, depending upon whether drawn from the position of the state, the educational organization, or students. At the state level, education is qualitative if it allows implementation of the chosen strategy for the development of the economy and society. At educational organisation level it involves the correspondence of the results of training to the requirements of FGOS. Then at the level of the consumers of educational services (trainees, parents) it is primarily about the conformity of the results of training to the requirements of employers and the labour market. For employers the quality of education, initially, is related to the level of professional competence shown by the graduates.

Diversity in the methods of interpretation when dealing with issues involving the quality of education make it difficult to achieve a high level of accuracy. Therefore, to best enable the development of a successful education strategy, a coordinated assessment of the quality of education is necessary. This should take into account the interests of all stakeholders (trainees, parents, educational organisations) in order to reveal any shortcomings that may exist in educational activity and implementation.

The results of studies of the policies of educational institutions are of great interest in, and importance to, the understanding of the quality of educational services, particularly to the leaders of educational organisations and in their implementation of managerial strategies (The Policy of Educational…). Furthermore, survey data collected from school principals shows that receiving the approval of the school populace is more influenced by popularity / prominence among the city's general population (k = 0.86, with the maximum k - 1), a high percentage of graduates who go on to enrol at university (k = 0.82), high ratings among trainees and their parents (k = 0.82), the appointment of renowned managers and educators (k = 0.80), the number of graduates with a high score of USE (k = 0.80), the quality of facilities and equipment essential to the needs of a modern educational institution (k = 0.79), high achievements of students in Olympiads and other competitions (k = 0.77), diversity in profile training programs (k = 0.74), the variety of additional training programs (k = 0.73), and school transport accessibility (k = 0.70).

The data contained in the survey of heads of educational organisations suggests full agreement with the criteria and indicators that refer to the contribution made by educational organisations to the quality education of Moscow schoolchildren. These concern the pass results attained by students of different levels of diagnostics; development of the talents of students; the effectiveness of pre-school groups; prevention of transgressions and misdemeanours; work carried out with students who require special educational needs; the effectiveness of the city's socio-cultural resources in training; professional skills and the further development of professional skills; the development of large scale participation in amateur sports (Development and Methodology …).

The listed criteria for the quality of education should be considered in the following context and conditions: first, dynamics, and secondly, with regard to the quality of the resources provided and with which the educational results were achieved.

These contexts are consistent with the results of research carried out by G.A. Yastrebova, A.R. Bessudnova, M.A. Pinskaya and S.G. Kosaretsky. In their works it was shown that the academic achievements of students - which are taken into account when drawing up the ratings of schools - consistently differ in educational establishments due to different personnel, different material support and a differing social composition of schoolchildren (Yastrebov et al., 2013).

In a number of foreign works (Bourdieu, Passeron, 1970; Coleman, 1966) and also domestic studies (Agranovich, 2008; Konstantinovsky, Voznesenskaya, 2011; Pinskaya et al., 2011; Bochenkov, Valdman, 2013; Bolotov, Valdman, 2013; Yastrebov et al., 2014; Derbishinir, Pinskaya, 2016), researchers have examined the quality of education in connection with the problems of socioeconomic inequality. These studies point to the illegitimacy of determining the effectiveness of an individual organisation, or an entire educational system, outside of their social and economic context (Yastrebov et al., 2014). The inclusion of contextual data in the quality management system

of education allows us to develop an effective and balanced policy that allows emerging problems to be responded to and adequately addressed (Yastrebov et al., 2014).

In many countries (Australia, United Kingdom, USA, Chile), the overall performance of an individual school is assessed by taking into account contextual information (data on the age, ethnicity and socio-economic composition of students). This strategy was used by Russian scientists in the study of the educational infrastructure index of Russian regions (Index of educational…). The quality of the modern educational infrastructure is seen as "a complex of interconnected systems, facilities, activities, resources and means that make up and / or provide the basis for the functioning of the entire education system and each educational organisation" (Index of educational…).

The data obtained from study of the educational infrastructure of the subjects of the Russian Federation at the pre-school, general school, secondary school, supplementary and professional levels of education show that the most developed elements are: the material and technical equipment available to additional and professional areas of education; the regional educational network of pre-school and additional education, plus staffing of additional education services. The index of general education in the country is one of the lowest rated. At the same time, the research notes an uneven development of the varied elements that make up the educational infrastructure. The widest dispersion of regional values is observed in: staffing of professional and pre-school education; the provision of conditions and facilities with which to deliver quality education for disabled students – particularly at the level of general and additional education; and finally the presence of a regional educational network at vocational education level (Index of educational…).

Based upon the requirements of the FGOS – with regard to conditions for the implementation of educational programs at preschool and general education levels – a qualitatively-built educational infrastructure pre-supposes the provision of personnel for information-methodological and psychological-pedagogical methods, plus the necessary material and technical support of educational organisations. Such resources hugely enhance the possibility of obtaining a quality education.

The problems associated with efforts to improve the quality of education through assessment are reflected in a large number of publications. These include various monitoring and diagnostic studies on the evaluation of school achievements. Tools for testing educational achievements involve; teaching programs for training / further training in assessment, plus assessing the conditions for the implementation of basic educational programs in educational organisations; tools for secondary / in-depth analysis of the results of evaluation of educational achievements; research on the use of data obtained from various assessments for the management of the educational process and educational systems; the self-assessment procedures of the individual school or educational establishment; making use of various options for external evaluation of school activities; portfolios of pupils and teachers, the methodology of the intra-class evaluation, etc. (Data bank…).

According to the Federal Law 'On Education in the Russian Federation', the following measures are core criteria by which to assess the quality of the educational activity of an organisation:

Openness, plus access to information about the organisation; the comfort and conditions in which educational activities are carried out; goodwill, politeness, competence of employees; plus satisfaction with the quality of educational activities provided by the organisation (Federal Law …).

FGOS of the basic general education contains a reference that suggests the control and assessment of the quality of education should be conducted by the following: The heads of the organisations which carry out educational activities; their deputies, who, within their competence, are responsible for the quality of the rudimentary educational program of basic general education; employees of organisations that evaluate the quality of education, including public organisations, associations and professional communities that provide public expertise within organisations that carry out educational activities; heads and specialists at government bodies of the Russian Federation that exercise public administration in the sphere of education, state control (supervision) in these same areas; managers and specialists of state executive bodies that ensure the development of order, control and the measuring materials for the final certification of graduates (Federal state…). Thus, this document establishes a multi-level system for the quality

control of education. This involves not only issues of control not just at state and regional levels, but also by the educational organisation itself, plus the public associations involving teachers and the parents of students.

The draft concept of the all-Russian system for assessing the quality of general education presents a model for an effective system of assessment that takes into account all levels (federal, regional, municipal, school) (Concept and plan of events...). At the municipal level, the quality of conditions provided to the educational organisation at all levels of education is assessed through monitoring the accessibility and variability of education in the educational institutions of the municipality. Add to this the monitoring of educational conditions of schools for the implementation of basic educational programs.

2. Relevance

In the analytical work of Russian scientists, great emphasise is placed upon the role of international cooperation in the field of improving the quality of education. References are made to convergence of views on evaluation criteria and study of the processes of analysing education in different countries. V.A. Bolotov and I.A. Waldman have great appreciation for, and experience of, such cooperation and have noted that: "International studies of the quality of education are instigating a revision of the national curriculum, influencing the introduction of new standards, affecting change in teacher training programs. The participation of the Russian Federation in international monitoring of the quality of education has contributed to the formation of a culture of pedagogical measurements, the reform of the content of education and the creation of federal state educational standards for the emerging generation (FGOS), the development of new textbooks, and the updating of teacher development programs" (Bolotov, Valdman, 2014).

In this regard, as an assessment of the quality of education through the assessment of the educational environment, we take into consideration the SACERS (School-Age Care Environment Rating Scale) (Environment Rating...).

3. Materials and methods.

The SACERS (scales) were employed as the main method for study of the educational environment for this modification (Ivanova, Vinogradova, 2017).

The SACERS are a diagnostic tool and part of the Environmental Rating Scale program. This includes: ITERS (Infant / Toddler Environment Rating Scale) – scales for the assessment of the environment and care for toddlers (Environment Rating...), ECERS (Early Childhood Environment Rating Scale) (Remorenko et al., 2007; Shiyan et al., 2016), plus FCCERS (Family Child Care Environment Rating Scale) – which are scales of environmental assessment in family education (Environment Rating...).

The SACERS are a tool for assessment of the educational environment of a school - at primary and basic general education level – during a whole day. The scales were developed in the USA, have subsequently been used in countries such as Canada, Vietnam, South Korea, Chile and Sweden) and further been translated and largely applied in schools in Germany and France (Harms et al., 1996; Tietze et al., 2007). The main objective of the SACERS scales is to create an appropriate educational environment for children of primary and secondary school age, one which will make a child's time at school a more comfortable and safe experience.

The SACERS are constructed on the basis of criteria for the quality of education of school-age children, childcare programs (Albrecht, 1991), the evaluation of the quality of programs for school-age children (ASQ) (O'Connor 1991) and the evaluation of early-learning programs (Abbott-Shim, Sibley, 1987). They are further based upon research results (Baillargeon, Betsalel-Presser, Joncas, & Larouche, 1993; Betsalel-Presser, Joncas, 1994; Jacobs, White, Baillargeon, & Betsalel-Presser, 1991; White 1990; Galambos, Garbarino, 1983; Vandell & Corasaniti, 1988; Vandell, Henderson, & Wilson, 1988; Seligson, Allenson, 1993) (Environment Rating...).

The SACERS method consists of seven scales:

1. Scale for 'Space and Furnishing'. This scale assumes an assessment of the available inner space and of the location of the premises, space for gross mobile activity, space for privacy, premises for staff, plus physical assets such as furnishing for learning and recreational activities, etc.

2. Scale for 'Health and Safety'. This scale assumes an assessment of the educational environment for the following indicators: physical and psychological health and safety during activities, catering, etc.

3. Scale for 'Activities'. This scale is represented by indicators that characterise the organisation of extracurricular activities and additional educational services: these features encompass visual arts and technology, design, music and dancing; theatrical activities, science and teaching, research activities, etc.

4. Scale for 'Interaction'. This scale reflects the parameters related to interaction and communication in the system between the three parties involved: 'Learner-Teacher', 'Learner-Learner', 'Teacher-Teacher', 'Teacher-Parent'.

5. Scale for 'Program Structure'. The indicators of this scale are assessed: the schedule and daily routine, variability of supplementary education programs, etc.

6. Scale for 'Staff Development'. This scale contains indicators that assess the activities of teachers and also the opportunities available to aid their professional development.

7. Scale for 'Special Needs'. This scale involves indicators that illustrate the creation of conditions for interaction and the education of students with disabilities.

The presented scales enable assessment of the educational environment of the educational organisation. This includes a set of educational conditions (excluding financial ones) that are required for the implementation of both the basic programs of primary, plus basic general, education.

48 indicators are used to build up accurate scale data. Each of these indicators are evaluated on a 7-point scale and these, in turn, reveal the level of development of the educational environment ('unsatisfactory', 'minimal', 'good', 'excellent').

The assessment is based upon observation, clarifying questions with the employees of the educational organisation.

The value of the SACERS scale as a tool for studying the educational environment is determined by the fact that it is:

- an instrument of development, not just an assessment of the educational environment;
- based upon the criteria for the amplification of the development of school-age children, the fulfilment of the needs of their development in the conditions of the school;
- a valid, reliable tool for evaluating the educational environment, as used in many countries (Germany, France, USA, Sweden, etc.);
- comparable with the scores of the quality of education in pre-school educational organisations ECERS-R (Early Children Education Rating Scale), tested in Russian kindergartens / playschools (Remorenko et al., 2007; Shiyan et al., 2016).
- a system that enables international comparative studies (Ivanova, Vinogradova, 2017).

During the processing of the study data of the educational environment - using the SACERS scale – it is determined:

- the index of the quality of the educational environment of the educational organisation – which is the total value for all indicators of the scale, divided by the number of these indicators). The quality index makes it possible to rate the level of development of the educational environment from 'unsatisfactory' (1 point) to 'excellent' (7 points);
- quality index for individual components of the educational environment (space and furnishing, health and safety, activities, interaction, learning process, staff development, special needs);
- the quality profile of the educational environment within the educational organisation – which represents the average values for 48 indicators and enables the identification of 'well-being zones' and the deficiencies in the development of the educational conditions of each particular educational organisation.

Design study of the educational environment using the SACERS scales.

Translation and preliminary adaptation of SACERS scales, correlation with SanPiN, FGOS NOO and OOO, OOP, NOO and OOO. Pilot study into the structural divisions of educational organisations in Moscow, plus the Moscow Region (N = 26) (2015-2016) (Ivanova, Vinogradova, 2017).

Indicators of the reliability and validity of the SACERS scales are:

1) Consistency of expert assessments. An analysis of the divergence of expert estimates showed that 78 % of the discrepancies are below 0.20, whilst the remaining 22 % of discrepancies range from 0.20 to 0.41. The data may indicate sufficient consistency amongst experts in their 'reading' (interpretation) of the scores and results obtained via SACERS.

2) Differential ability of indicators: interior space and furnishings – 96 %; health and safety – 72 %; active activities / pastime – 95 %; interaction – 95 %; educational process – 94 %; staff development – 99 %; special needs – 99 %. The total discrimination ability of the scales was 93 %.

2. Training of experts: teachers, psychologists, directors and deputy directors of educational organisations, teachers from the higher education institutions of Moscow within the framework of advanced training courses, 'Expert evaluation of the educational environment of the school'.

3. Study of the educational environment using SACERS (modified version) (N = 33) (2016-2017). This sample has been developed from the educational organisations of the city of Moscow, implementing programs of primary and basic general education.

In processing the data obtained, the following descriptive statistical methods were used: mean, variance, standard deviation, median, plus confidence interval. For comparison of independent groups, the Student's T-criterion for independent samples was employed.

4. Discussion

Let's turn to the results of the study of the educational environment of Moscow schools, using SACERS (scales). In the course of the study, the quality index of the educational environment was calculated, and was 4.42 points. This value matches the average level of development of the educational environment and indicates a satisfactory potential of the educational organisation – in terms of creating educational conditions.

The quality index of the educational environment in the study group ranges from 2.2 to 6.8. These estimates vary quite significantly, something with might indicate considerable differences between the studied schools. This can be caused by unequal opportunities offered in the educational environment of the particular schools of the sample.

The values of the quality of the components of the educational environment (Space and Furnishings, Health and Safety, Activities, Interaction, Program Structure, Staff Development, Special Needs) are presented in the table 1.

Analysis of the range of mean values of the components of the educational environment (<X> min, <X> max, σ (X)) has revealed a tendency for a wide spread of these values. This indicates significant differences in the educational conditions at the schools included in the sample. The greatest variation (standard deviation from 2.03 to 2.38 points) is demonstrated by those components of the educational environment where there are lower mean scales ('Space and Furnishing', 'Health and safety', 'Activities', 'Special Needs') (Table 1).

Table 1. The values of the quality of the components of the educational environment

Scales	<X>min	<X>max	<X>	σ(X)
Space and Furnishing	3,85	4,29	4,07	2,03
Health and Safety	3,89	4,50	4,20	2,38
Activities	3,57	4,15	3,86	2,27
Interaction	4,84	5,34	5,09	1,94
Program Structure	4,47	5,07	4,77	1,85
Staff Development	5,00	5,76	5,38	1,80
Special Needs	3,99	4,90	4,44	2,22

The system for assessing the educational environment – on the basis of the international SACERS (scales) - provides a more discerning view of the level of development of the individual components of this environment, plus a profile of its quality. It is on this basis that zones of well-being and risk are defined.

The profile of the quality of the educational environment is shown in Figure 1.

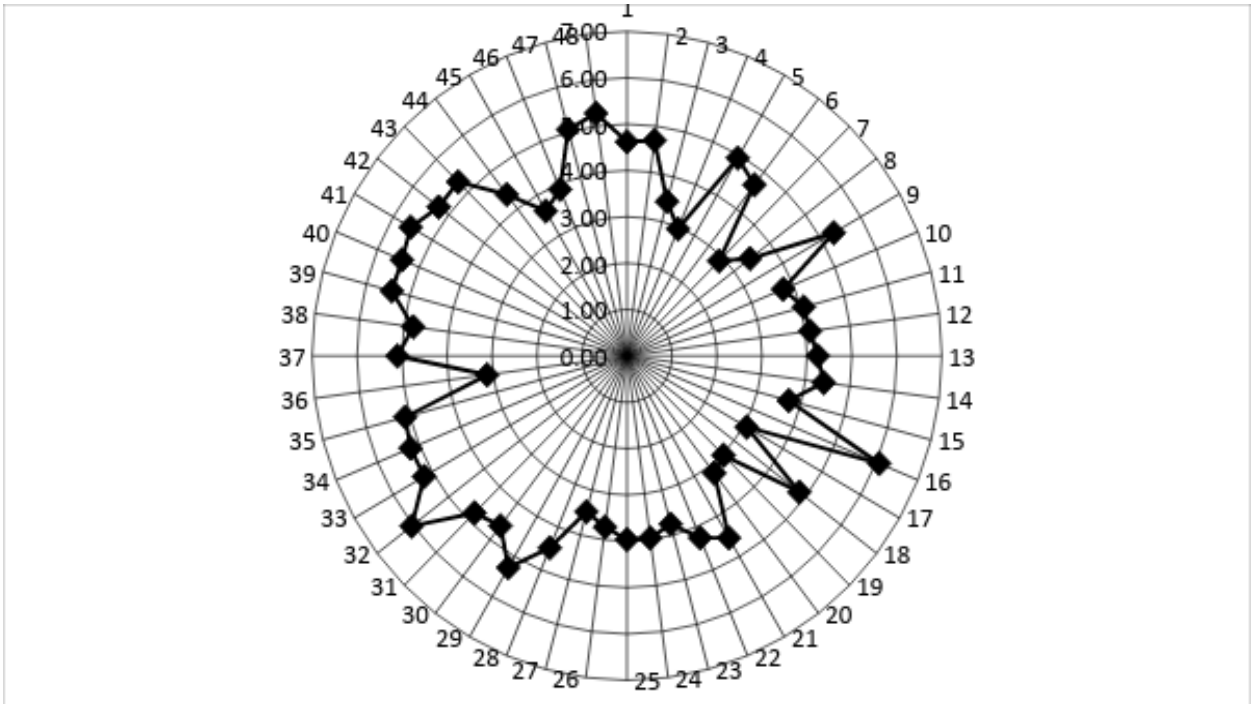

Fig. 1. Quality profile of the educational environment of Moscow schools

The overall picture of the well-being zones, plus the deficiencies of the educational environment presented in Table 2.

Table 2. Zones of wellbeing and deficiencies in the educational environment of Moscow schools

Zones of well-being	Deficiencies
Furnishings for Routine Care	Space for Privacy, Room Arrangement
Access to Host Facilities, Free Choice	Arts and Crafts, Language /Reading Activities, Science /Nature Activities, Cultural Awareness.
Staff-child Interactions, Peer Interaction, Interaction Between Staff and Parents	Departure
Discipline	Personal Hygiene
Use of Community Resources	Furnishings for Relaxation and Comfort
Staff Development	Schedule
Peer Interactions	Individualization

The basis for designing the educational environment of an educational complex can be the predicted values of the components of this educational environment, compiled from the sample as a whole (Figure 2).

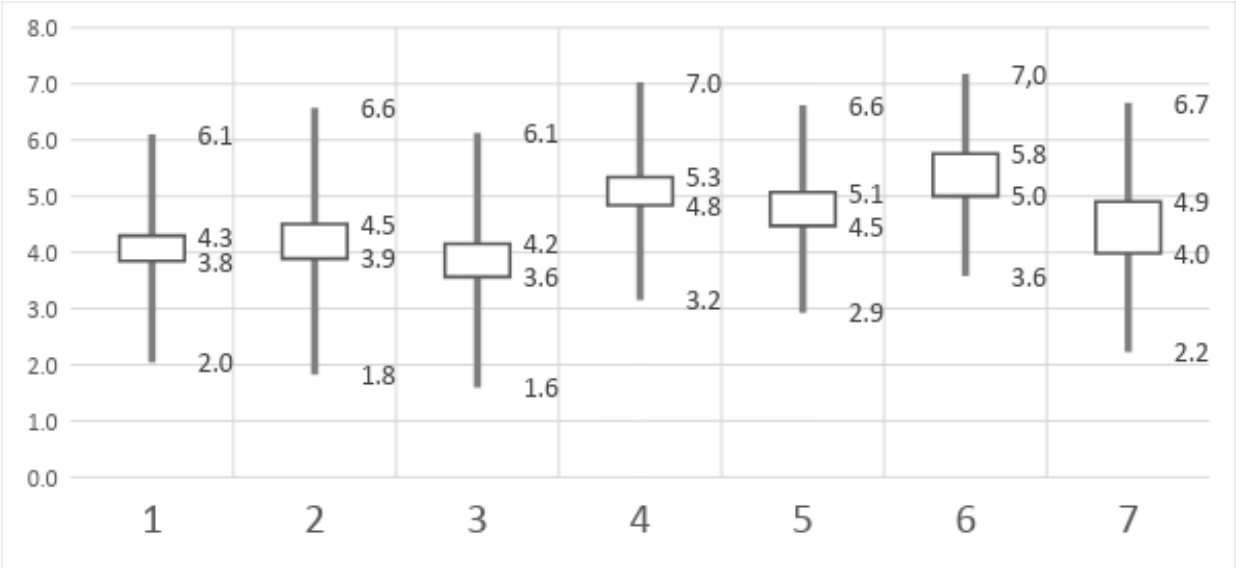

Fig. 2. Prognostic range of quality of the components of the educational environment

Discussion of the results of the study of the educational environment of Moscow schools, using the SACERS (scales) will be carried out with respect to the results obtained in the educational organisations of Germany (Table 3) (Tietze et al., 2007).

Comparison of these results with those obtained from Russian schools is currently not possible due to none yet existing.

Table 3. The values of the quality of the components that form the educational environment of educational organisations in Russia and Germany

Scales	Russia				Germany			
	<X>min	<X>max	<X>	σ(X)	<X>min	<X>max	<X>	σ(X)
Space and furnishing	3,85	4,29	4,07	2,03	2,42	6,5	4,72	0,77
Health and safety	3,89	4,5	4,2	2,38	2,00	6,71	4,18	1,10
Activities	3,57	4,15	3,86	2,27	1,88	6,63	4,40	0,93
Interaction	4,84	5,34	5,09	1,94	3,11	6,88	5,66	0,79
Program Structure	4,47	5,07	4,77	1,85	3,25	7,00	5,21	0,87
Staff development	5,00	5,76	5,38	1,8	3,00	7,00	5,40	0,83
Special Needs	3,99	4,90	4,44	2,22	3,83	7,00	6,10	0,88

As can be deduced from Table 3, for six components of the educational environment, the indicators for Moscow schools (with the exception of the 'Health and Safety' scale) are less important than they are to educational organisations in Germany.

Regarding the quality data of the components of the educational environment of Moscow schools in this table (Table 3), the following points can be highlighted:

- low scores on the 'Space and furnishing' scale when compared with other scales (4.07 points), are explained, as a rule, by the typical design of school buildings. (Inconvenience related to location of the premises, which makes it difficult to move, restricts the ability to carry out a wide enough variety of activities, plus unable to provide sufficient visibility of premises).

The data obtained indicates that the main problems related to space provision within Moscow schools are: the lack of educational space, an inability to transform space for multiple uses - organisation of various forms of curricular and extracurricular activities. It is important to reconsider the organisation of the school space in order to ensure their multi-functionality and transformability into small, medium and large areas, on the basis of the 'student-group-class-flow' principle;

- the value of the indicator on the 'Health and Safety' scale (4.2 points) can be explained by the following: Educational organisations currently have no opportunity to organise meals based upon the individual needs of each child (this is most clearly demonstrated in the organisation of food for allergic children); the organisation of the activities of medical personnel (the presence of a medical worker, as a rule, is limited to two days a week) and the management of all questions relating to the health of the trainees; a limited number of systematic measures to protect health and to promote healthy lifestyles;

- lower rates on the 'Activities' scale (3.86 points) in Moscow schools compared to educational organisations in Germany (4.40 points) (Table 3), due to the lack of specialised facilities, limited resources for the implementation of the proposed programs (a variety of materials, equipment in the premises, etc.), lack of free access to materials outside of those sessions especially organised with the teacher;

- values on the scale of 'Interaction' (5.09 points). Values on this scale correspond to a 'good' level. High scores indicate the good potential of Moscow schools, in terms of interaction between students and teachers, teachers and trainees, plus teachers and parents;

- the data on the 'Program Structure' scale (4.77 points) shows positive trends in ensuring the variability of supplementary education programs and extra-curricular activities, plus the use of the sociocultural space of the city. (This latter, referring to the participation of schools in the projects 'Museums, Parks, Manors', 'History and culture of the churches of the capital', and also ensuring that the connection between generations will not be interrupted, etc.). In this scale deficiency was indicated in the area of 'schedule and schedule of the day'. The values on this scale indicate a lack of flexibility in the schedule, the predominance of class-curricular forms of learning activity, the inadequacy of activities that ensure energetic interaction between students, especially in the open air;

- the highest values were attained on the 'Staff Development' scale (5.38 points), which is largely due to favourable conditions created in the Moscow education system – specifically involving the professional development of teachers;

- data on the scale of 'Special Needs' (4.44 points) indicates a lack of special conditions for students with disabilitiese. Comparison with German educational institutions (6.1 points) on this scale shows that it is the largest, relative to other scales (Table 3). This may indicate that in the educational institutions of the Moscow region, as a rule, the tasks and characteristics of inclusive education are poorly taken into account.

When considering the reliability of the differences in the group of Moscow schools with those of educational organisations in Germany, we established opinion based upon the Student's T-criterion (Table 4).

Table 4. The average values of the gaming competencies and the difference in their values – according to the Student's T-criterion in the educational organisations of Russia and Germany

Scales	Educational Organizations		Student's T-criterion
	Russia	Germany	
Space and Furnishing	4,07	4,72	- 1, 720
Health and Safety	4,2	4,18	, 043
Activities	3,86	4,40	-1, 280
Interaction	5,09	5,66	- 1, 563
Program Structure	4,77	5,21	- 1, 236
Staff Development	5,38	5,40	-, 057
Special Needs	4,44	6,10	- 3,994***

Here: *** - p < 0, 001 при f =64

As can be seen from Table 4, the results obtained from the data of educational organisations in Germany are significantly higher - compared to data obtained in Moscow schools – on the scale of 'Special Needs' (t = -3.994 for p <0.001). As a rule, in Moscow, most schools create the minimum educational conditions required for students with disabilities (for example, only school entrance and toilets are adapted for such children). Not all teachers possess the necessary

knowledge to satisfy students with special needs. There is no provision of the specialist equipment necessary in order to train and rehabilitate children with disabilities, therefore such children cannot receive educational services on an equal basis with their peers. Participation in general school activity by the children of this group is very limited.

The results do show that shortcomings caused by objective reasons are compensated for by a high level of professional training of teachers, plus the organisation of interaction between all participants in the educational process.

Let's turn to the analysis of the quality profile of the educational environment (Figure 1).

The highest values (6.0 points) were obtained from the scale indicators of 'Attendance' and 'Discipline'. This reflects the general trend observed, where the main focus of school activity has shifted towards control-disciplinary influences upon students.

High scores were found in the 'Access to Host Facilities' (5.31 points). This is a combination of schools of different orientations in educational complexes that have been allowed to expand the range of programs offered. For example, in some educational organisations, the number of after-class activities and additional educational services reaches 200. However, attention should be paid to the availability of specially equipped premises, as the provision of a sufficient amount of materials and equipment for the implementation of all areas of extracurricular activities and additional educational services is an indicator of the zone risk. Therefore, the values observed in the indicators for 'Arts and Crafts', 'Language / Reading Activities', 'Science / Nature Activities,' are in the range from 3.0 to 3.8 points. Risks are determined not only in terms of the availability of the variety of facilities, equipment and materials for these types of activities – which might allow work to take place in a group, individually - but also by the opportunities to enjoy free access to them during the period of time that students are in school attendance.

The lowest values were obtained from the 'Space and Furnishing' scale, specifically in terms of 'Room Arrangement' (2.97 points) and 'Furnishings for Relaxation and Comfort' (2.90 points). These data indicate deficits in the provision of well-equipped specialised spaces for a variety of activities, insufficient spaces in general, as well as spaces for self-use by children, more private spaces for homework, or other independent study. Deficiency Zone relates to space and furnishing for relaxation and comfort. In educational organisations we often observe a limited number of comfortable spaces, there is no 'softness' of space, or accessibility to any for students. So, for example, there is no 'free' or continual access to 'soft' spaces such as of game rooms, spaces for musical entertainment or assembly halls.

As for the indicator 'Schedule' (3.14 points), the electronic system 'Moscow Electronic School' is widely distributed to Moscow schools. This provides constant access to the schedule and changes therein. Deficiencies are determined in the content and flexibility of the schedule, the representation of various forms of lesson and after class activities (excursions and travel activities - including outdoors in favourable weather conditions, etc.).

During the course of the study it was revealed that, on the 'Special Needs' scale, the high values of indicators are rarely observed. This is particularly evident in the indicators for: 'Provision for Exceptional Children', 'Individualization', 'Multiple Opportunities for Learning and Practical Skills'.

The difficulties of creating equal educational conditions for students with HIA are also connected with the organisation of the internal space in large schools. The administration of such schools is faced with the need to re-equip the environment for the needs of children with special educational requirements. In these instances the layout of most buildings, the equipment of classrooms, laboratories and workshops, relaxation zones for students, recreation of the pedagogical staff, and the equipping with technical means of training and rehabilitation of children does not always correspond to the special educational needs of this category of students.

The obtained data reveals the content characteristics of the educational environment, sets the criteria for its development and can become the basis for designing the educational environment, determines the direction of development and pointers towards constructing the trajectory of its changes (Vinogradova, Ivanova, 2018).

5. Conclusion

1. SACERS scales can be considered as an effective tool for assessing the educational environment of Moscow schools because:

- the content of the indicators reflect the basic requirements of the regulatory framework of Russian schools. Moreover, each scale replicates certain aspects of the educational environment, while indicators within the scales help differentiate the actual and desired (required) state of the educational space;
- SACERS have a distinctive and high competence. The total discrimination ability of the scales was 93%;
- they enable a more accurate identification of the quantitative and qualitative characteristics of the educational environment, which are often difficult to measure and to express through the quantitative indicators used in the rating system;
- SACERS facilitate a differentiated view of the existing conditions. This helps to reveal potential for improvement within an educational organisation. On this basis it becomes possible to solve the management task of systematically eliminating deficiencies and determining the vectors for the development of the educational environment - yet excludes the possibility of using this tool as a means of control.

2. During the study of the educational environment using the SACERS (scales), the following features were revealed:

- the quality index of the educational environment of Moscow schools was 4.42 points. This value is the average level of development of the educational environment and indicates the potential for the educational organisation to improve - in terms of creating better educational conditions;
- the spread of figures relating to the quality index of the educational environment (in the study group ranging from 2.2 to 6.8 points) is quite wide. This indicates a significant difference between the schools studied, a factor that may be due to the unequal opportunities of the educational environment of the schools in the sample;
- low values of the indicators on the 'Activities' scale (3.86 points), compared to other scales, are due to the lack of specialised facilities, limited resources for the implementation of the proposed supplementary education programs, plus the lack of free access to materials outside of specially organised sessions with teachers;
- low values on the 'Space and Furnishing' scale in comparison with other scales (4.07 points) are explained, as a rule, by the typical design of school buildings;
- values on the scales for 'Interaction' (5.09 points) and 'Staff Development' (5.38 points) indicate the positive potential of Moscow schools, in terms of interaction between students and teachers, teachers and students, plus teachers and parents. They also point to favourable conditions created in the system of Moscow education in terms of the professional development of teachers.

3. Analysis of the values of each individual indicator made it possible to identify:

- that the highest values in the scales were obtained from the 'Attendance' and 'Discipline' indicators. This reflects the general trend observed in schools, whereby the main focus of activity is shifted towards control-disciplinary influences upon students;
- that the high scores on the 'Access to Host Facilities' indicators point towards a unification of Moscow schools of different orientations into educational complexes that are allowed to expand the range of these programs;
- that the lowest values were obtained in terms of 'Room Arrangement' (2.97 points) and 'Furnishing for Relaxation and Comfort' (2.90 points). The data for these areas indicate deficiencies in the provision and equipping of specialised spaces for a variety of activities, plus lack of space and furnishings for relaxation and comfort;
- that funds are defined in the content and flexibility of the schedule (based upon the analysis of the values of the 'Schedule' indicators), as well as the representation of various forms of the lesson and after-hour activities (excursions, motor activities, including outdoors in favourable weather conditions, etc.);
- that high value scores are rarely observed in the indicators for the areas covered by 'Provision for Exceptional Children', 'Individualization', 'Multiple Opportunities for Learning and Practical Skills'.

4. Prospects for the use of SACERS scales:
- creation of a system of external independent audit;
- design of the educational environment, based upon data obtained using scales;
- conducting cross-cultural research.

Acknowledgments

The publication was prepared in the framework of the research work 'Development of a Model for Optimising the Development of the Educational Conditions of Moscow Schools to Ensure Equal Access to Quality Education Using the International Scale, SACERS', carried out at the Institute of System Projects of the State Unitary Enterprise 'Moscow City University'.

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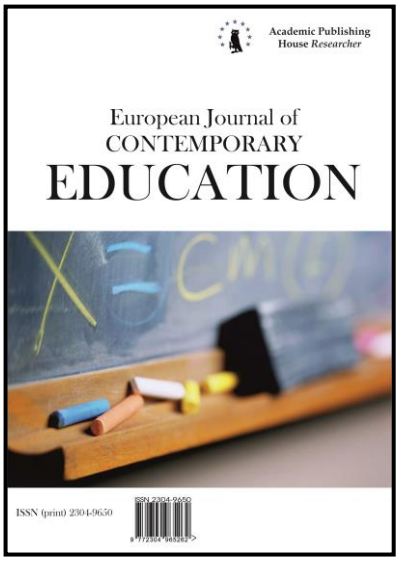
Published in the Slovak Republic
European Journal of Contemporary Education
E-ISSN 2305-6746
2018, 7(3): 511-520
DOI: 10.13187/ejced.2018.3.511
www.ejournal1.com



The Practice of Implementing Bologna Process in the Education Sector in the Russian Federation: Trends and Consequences

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Abstract

The article presents studies that contribute to the ongoing discussion on the higher education reform in Russia in accordance with the Bologna Process.

Currently, many higher education institutions of the country have implemented a two-tier system of education, where the first-tier of higher education is bachelor's degree program with the average period of study equal to 4 years, the second-tier of higher education is master's degree program designed for training for 2 years. The specialist degree program remained only in the technical universities. Recently, bachelors make up the main percentage of university graduates. Not many young people enter the master's degree program, mostly those students who plan to devote their future activities to science.

The number of studies, currently available in literature, confirming the effectiveness of the transition of higher education to training students under the bachelor's degree program, as well as the demand for these graduates on the labor market, is not high. Are employers ready to employ graduates with bachelor's degree?

In this article, firstly, the attitude of employers to the transition to the two-tier system of higher education was studied. Secondly, the employers' loyalty level to a potential employee with a bachelor's degree was determined. Third, the analysis was carried out to reveal the employment of graduates from higher educational institutions with bachelor's, specialist, and master's degrees. Also, the article presents the dynamics in the number of students with the bachelor's, specialist, and master's degree graduated over the recent five years. Limitations of career growth of graduates with the bachelor's degree were analyzed, and the opportunities to overcome their employment problem were suggested.

In consequence of the conducted study of the transition of Russian higher education to a two-tier education system, recommendations are formulated to promote the recognition of the bachelor's degree program graduates in the labor market.

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The outcomes of the study gain the knowledge about the higher education reform in the Russian Federation, which is conducted in accordance with the Bologna Process, as well as give an idea of the employers' attitude towards graduates of the bachelor's degree program.

Keywords: Bologna Process, education level, bachelor's degree program, specialist degree program, master's degree program, employment of graduates, career, education quality, labor market, higher education.

1. Introduction

In the current context in Russia, higher education, career, and professional growth are the priority life values.

Fifteen years ago, due to joining of Russia to the Bologna Process, the higher education in the country had received a new course of its development and renewal. There were many disputes and discussions in the scientific community, whether moving towards a two-tier education was expedient. However, there is still no consensus on the feasibility of Russia's entry into the European Higher Education Area, and the answer to the question, what are positive and negative results that Russian higher education has received in the course of these changes.

An important criterion for assessing the education quality is the demand for specialists having graduated from higher education institutions. This is the issue we will try to deal with and find out how employers treat bachelor's program graduates of higher education institutions, whether or not they trust the new education standards.

At present, after the transition of Russia to a two-tier higher education system, the employment problem of graduates of higher education institutions with bachelor's degree, became quite relevant and requires the solution at the highest level.

Analysis of recent publications on the problem. The issues of higher education reform in accordance with Bologna Declaration, the transition to two-tier education system of bachelor's and master's degree programs, as well as employment of graduates are reflected in the works of Russian scientists, such as A.Yu. Aleksandrov (2013), E.V. Andryushina, N.O. Lutsenko (2014), I.E. Zadorozhnyuk (2012), S.V. Vikhareva et al., (2010), N.R. Kamynina, A.O. Grudzinsky (2017), R.V. Kupriyanov, (2014), S.I. Plaksy (2014), A.A. Plisova (2017), A.A. Solovov (2016), N.V. Bagrova (2017), M.E. Pankratova, N.Y. Rasheva (2014), M.V. Vinichenko et al. (2016), M.V. Maksimenko, N.N. Kryzhevskaya (2018), A.A. Ilyashenko (2017).

2. Materials and Methods

The goal of the present research is revealing the effect of education transition to a two-tier education system on the quality of training, as well as determining the credibility of the employer to graduates who have studied under the bachelor's degree program.

The research deals with the following issues:

1. Definition of the purpose of Russia's accession to the Bologna Process;
2. Analysis of the all-Russian survey of companies, hiring graduates of higher educational institutions with bachelor's, specialist, and master's degrees, conducted by Career.ru portal in 2011;
3. Analysis of sample observation of employment of graduates of higher education institutions, conducted by the Federal State Statistics Service (Rosstat) in 2016.

The empirical base includes the results of the research performed by the author on the basis of the data obtained through the all-Russian survey of 500 companies hiring young professionals conducted by Career.ru in 2011 and selective observation of the employment of graduates who received higher education in 2010-2015, conducted in 2016 by the Federal Service for State Statistics.

In accordance with the Order of the Federal State Statistics Service No. 169 dated April 1, 2016 "On approval of the Main Methodological and Organizational Provisions for Conducting a Sample Survey of Employment of Graduates of Vocational Education Institutions" (Prikaz Federal'noi sluzhby..., 2016) The Federal Service for State Statistics for the first time conducted a selective observation of the employment of graduates who received secondary vocational and higher education (hereinafter – selective observation).

"The selective observation was carried out in compliance with the Resolution of the Government of the Russian Federation of November 27, 2010 No. 946" On the organization in the Russian Federation of a system of federal statistical observations on socio-demographic problems

and monitoring of economic losses from mortality, morbidity and disability of the population. " The observation was an additional module for a selective survey of the workforce and was carried out monthly from April to September 2016.

Units of observation are persons with the following educational levels: higher education (bachelor's degree, specialty, master's degree, top-level training), secondary vocational (including former primary vocational) and graduated from the educational organization in 2010-2015. Persons who received for the period from 2010 to 2015. two or more educations are taken into account once for the higher level education (if two educations of the same level are received, then on the latter level).

The sample was formed on the basis of the primary information file of the All-Russia Population Census of 2010 and the Population Census in the Crimean Federal District of 2014, which contains information on the permanent population, i.e. population permanently residing in the territory of the corresponding district, city, settlement.

The sample of graduates was 36 thousand people, or about 0.3 % of the total number of graduates in 2010-2015. The volume of the sample array during the observation was more than 100 thousand households visited by the interviewers. The survey was conducted in those households in which the graduates who graduated from educational organizations in 2010-2015 lived.

The results of selective observation were extended to the general population according to current calculations, having the same characteristics as graduates of educational organizations. The methodology for weighing and disseminating sample survey data is based on assigning an appropriate individual weight to each individual unit of observation. The procedure for calculating weights is to compare each sample of the Russian Federation with a sample (the number of citizens surveyed) stratified by gender, five-year age groups, the type of settlement (urban, rural) with the general population according to current calculations stratified according to the same characteristics.

Based on the results of the observation, official statistical information has been generated reflecting the employment and degree of consolidation of graduates in the acquired profession (specialty) of secondary professional or higher education. The attached tables contain the following data:

- on the graduates of educational organizations in 2010-2015. and the process of their employment;
- on the results of employment and work activity of graduates in the first job;
- on the current situation of graduates in the labor market in 2016;
- about the current employment of graduates in 2016» (Prikaz Federal'noi sluzhby..., 2016).

The purpose of selective observation is the possibility to obtain official statistical information reflecting the employment and degree of consolidation of graduates in the received profession (specialty) of higher education.

The geographical scope of the selective observation of the employment of graduates of vocational education institutions is defined throughout the whole of the Russian Federation.

For carrying out respondents' survey, a questionnaire for selective observation of employment of educational institution graduates, who have received higher education, was approved in accordance with the order of Rosstat.

The authors also used general scientific methods of investigating the empirical level: observation, description, comparison and theoretical level: generalization, analysis.

The results of the study were obtained by analyzing the relationship between the level of education: baccalaureate, specialty, magistracy and the relevance of graduates of each level of education in the labor market.

The authors used the counting method for the Pearson's criterion χ^2. The results were significant at the level of reliability ($p < 0.85$).

3. Results

Since 2003, after signing the Bologna Declaration, the Russian higher education system was faced with the task of implementing the basic principles of the Bologna Process.

"To ensure this transition, the Ministry has developed and approved the State Educational Standards (SES) of higher vocational education (HVE), which reflected the principles of the Bologna Process" (Kupriyanov et al., 2014).

In 2005, the Ministry of Education and Science of the Russian Federation has developed a plan of actions to implement the provisions of the Bologna Declaration in the system of higher vocational education of the Russian Federation until 2010. "Goals of higher vocational education system development in accordance with the Bologna Declaration" were defined as follows:

1. Developing higher vocational education system based on two main tiers – bachelor's and master's degree programs;
2. Studying and implementing the European Credit Transfer and Accumulation System (ECTS);
3. Introducing the Supplement to Diploma for higher professional education, compatible with the European Diploma Supplement;
4. Creating and providing the comparable system of recognition in the Russian Federation of foreign documents on education, and recognition of Russian documents on education in the member states of Bologna Declaration;
5. Addressing the problem of education quality and development of comparable methodologies and criteria to assess the education quality;
6. Promoting the development of academic mobility of students and university teachers" (Prikaz Ministerstva obrazovaniya..., 2005).

It is believed that the main goal of all countries involved in the Bologna Process was creating the European Higher Education Area (EHEA). This task was achieved in 2010 through the efforts of all the participants, and it was announced about the creation of the EHEA. In 2017, 48 countries have become EHEA associates.

It should be noted that great hopes were laid on the EHEA in terms of gaining more attractiveness in the world educational community. National educational systems of European countries have gained the opportunity to extent their knowledge through the unique knowledge of the partner countries, which became possible due to the increased mobility of students and teachers.

"Another thought that is important to understand for the evaluation of the Bologna Process: EHEA is not a geographical concept. This is an aggregate of ideas and technologies associated with education, which were formulated by a number of European countries and developed jointly by all EHEA member states" (Kamynina, Grudzinsky, 2017).

Russian higher education took a tack on two-tier education system. The task was set to eliminate training at the level of specialist degree program, while implementing education at the levels of bachelor's and master's degree programs.

In order to determine the attitude of employers to the transition to a two-tier system of higher education, Career.ru portal has conducted a nationwide survey among 500 companies hiring graduates of higher educational institutions having bachelor's, specialist, and master's degree. The survey was conducted from 18 to 25 July 2011.

Answers to the question posed to companies whether bachelor's degree of their potential employee was sufficient to perform professional duties, were as follows: yes – 79, no – 21 %.

Table 1 shows the answers to the question posed to companies involved in different fields of activity: "Is bachelor's degree of potential employee sufficient to perform professional duties?"

Table 1. Answers to the question posed to companies involved in different fields of activity (Bachelor's degree graduates...)

Field of company's activity	Yes, %	No, %
Banks, finance, and insurance	92	8
Human resource management	90	10
IT/Internet	85	15
Service-to-business	83	17
Wholesale selling	82	18

Production	81	19
Retail network	80	20
Construction and real estate	54	46

Companies from banking and financial sector were more loyal to the graduates of higher educational institutions with a bachelor's degree. Among them, 92 % of companies were ready to hire graduates with bachelor's degree. Also, 90 % of companies involved in human resource management would have given preference to bachelors. The survey results indicate worse situation with respect to companies engaged in construction and real estate, from which just 54 % were ready to hire bachelors. At that, it was noted that the larger the company, the less demand they manifest for undergraduates with bachelor's degree.

During the survey, it was also revealed that 25 % of employers, who hired graduates of higher education institutions, gave negative assessment to the transition to a two-tier system of higher education, 64 % rated the transition neutrally, while only 11 % gave positive assessment.

"Currently higher education is perceived as a mandatory requirement of the employer, as a necessary but insufficient condition for obtaining a job in an effective segment of the labor market. Often, higher education is required even where it was previously not mandatory" (Solovov, 2016).

In the course of the survey on the employment of the university graduates, the respondents were asked questions related to different periods, namely training in an educational institution, the graduation from the educational institution, searching a job in the labor market after graduation, and the employment at the first job and current job.

Table 2 shows the data of a sample survey of employment of university graduates conducted in 2016 (Vyborochnoe nablyudenie...).

Table 2. Employment of graduates depending on their level of education for the period of 2010-2015 (thousand people)

	Total number of graduates	Including:					
		Total number of employed graduates	Among them		Total number of unemployed graduates	Among them	
			Those who were looking for a job	Those who were not looking for a job		Those who were looking for a job	Those who were not looking for a job
Total population							
Total number of graduates	6,476.9	5,860.2	3,965.1	1,895.2	616.7	296.9	319.8
Including those who has received higher education							
Higher education based on specialist and master's degree program	5,430.1	4,967.4	3,337.1	1,630.4	462.7	225.7	237.0
Higher education based on bachelor's degree program	1,046.8	892.8	628.0	264.8	154.0	71.2	82.8

Based on the data of the comparative table, it can be concluded that the categories of graduates considered in terms of the level of education of the specialty and the master's degree from 2010 to 2015 were employed by 4,967,400 people. 462.7 thousand people did not find a job.

At the same time, among bachelor's degree program graduates 892.8 thousand people were employed, whereas 154 thousand people were not employed.

Thus, we see that in the labor market the demand for specialty graduates and master's degree graduates is higher than that of bachelor's degree. Employers, in most cases, do not trust graduates with the bachelor's degree, they treat them as the graduates with incomplete higher education, believing that these graduates have insufficient theoretical knowledge and low level of practical skills in specialization. Nevertheless, salary expectations of the graduates are often overstated.

The problem of incoherence of the knowledge and skills, mastered by higher education graduates, with the requirements of employers is becoming increasingly acute.

To compare, it is necessary to provide data of selective observation of university graduates employment in 2016 in terms of percentage (Table 3).

Table 3. Employment of graduates depending on their level of education for the period of 2010-2015 (%) (Vyborochnoe nablyudenie...)

	Total number of graduates	Including:					
		Total number of employed graduates	Among them		Total number of unemployed graduates	Among them	
			Those who were looking for a job	Those who were not looking for a job		Those who were looking for a job	Those who were not looking for a job
Total population							
Total number of graduates	100	88.9	63.1	25.8	11.1	4.9	6.2
Including those who has received education							
Higher education based on specialist and master's degree program	100	91.5	61.5	30.0	8.5	4.2	4.4
Higher education based on bachelor's degree program	100	85.3	60.0	25.3	14.7	6.8	7.9

Analysis of Table 3 shows that 91.5 % graduates of specialist degree and master's degree programs, as well as 85.3 % of bachelor's degree program are employed, while 8.5 % of specialty and master's degrees, as well as 14.7 % of bachelor's degree programs graduates are not employed. The increase in the percentage of employment was influenced by the active search for job.

The percentage of unemployed graduates with respect to the level of bachelor's education is almost twice as high, the percentage of unemployed graduates in terms of education level of the specialty and magistracy, this result is statistically significant, since selective studies were conducted at the federal level, and the probability of accidental occurrence of the above mentioned indicators is small.

When comparing the indicators of the All-Russian survey among 500 companies hiring graduates of higher educational institutions in terms of the level of education of the bachelor's degree, specialty, master's degree conducted by Career.ru in 2011 with selective observations of the employment of graduates who received higher education by the Federal State Statistics Service in 2016 year, we can conclude that for five years there were very small positive changes (about 5 %) in the demand of employers for graduates of higher education Bachelor program.

"It seems that the key problem is how, while modernizing education, to preserve national and cultural traditions in this process. The modernization processes of the educational system should not violate cultural traditions. Historical experience in modernization of education accumulated by the world practice suggests that this process is necessarily accompanied not only by acquisitions but also by very significant losses" (Pankratova, Rasheva, 2014).

There is reason to believe that at this development stage of domestic higher education, it is necessary to develop new standards, not borrowed in the West, bat national ones, oriented to our mentality and economy, standards that will satisfy potential employers.

"For the full-fledged development of Russia, its revival in the future as a leader in the field of education, it is necessary to stop implementing Western models into the existing system, while continuing to integrate into the global and regional educational space" (Andryushina, Lutsenko, 2014).

Next, we consider the dynamics in the number of students studied according to the bachelor's, specialist, and master's degree programs in the five-year period from 2011 to 2016. Taking into account the demographic situation during the period from 1995 to 2000, called by sociologists the "demographic hole", when the birth rate decreased by 7.1% in the whole country, the number of students in higher education institutions decreased by 26.5% from 2011 to 2016. The economic crisis of 2012 also played a certain role.

The Higher School of Economics, at the support of the Ministry of Education and Science of the Russian Federation, as well as with the help of the Federal State Statistics Service, conducted a study on the development of general, secondary vocational, and higher education in the Russian Federation. The statistical book "Education in Figures: 2017" presents the number of students enrolled in higher educational programs (Table 4).

Table 4. The number of students enrolled in higher educational programs in 2011-2016 (at the beginning of the academic year, thousands of people) (Borodina et al., 2017).

	2011/12	**2012/13**	**2014/15**	**2015/16**
Total	6,490.1	6,075.4	5,209.0	4,766.5
Including based on the programs:				
Bachelor's degree programs	1,425.4	2,271.8	3,516.1	3,530.9
Specialist degree program	4,929.3	3,634.8	1,465.9	904.9
Master's degree program	135.4	168.8	227.0	330.7

The number of students who choose the bachelor's degree program increased in 5 years by 59.6 %, master's degree programs – by 59.0 %, whereas the number of students enrolled in the specialist degree program has decreased by 5.5 times.

This statistical information confirms the actual transition to the two-tier system in higher education. Enrollment of students to the specialist degree program is carried out mainly in technical universities.

"The desire of higher education institutions to bring the training of bachelors as close as possible to the training of specialists, traditionally perceived by employers, causes the mechanical transfer of disciplines from the previously existing specialist degree programs to the new bachelor's degree programs. At the same time, the variable parts of the program also acquire a professional orientation, often narrowly of subjective nature. The volume of disciplines for general education available in the curriculum of the specialty program is reduced and transferred at best to optional study, which is justified by the reduction of the standard terms of training according to new standards. However, even such professional orientation of the programs continues causing the employer's alertness to the bachelor's qualification (degree) (Aleksandrov, 2013).

It is necessary to pay attention to the fact that business is interested in competent professionals, and therefore it is necessary to determine the points of contact, when developing higher education standards in Russia. It is necessary tuning in to information coming from the labor market to determine what kind and how many graduates are needed for the effective development of the economy. It is necessary to attract enterprises for practical training of students, where they could gain practical experience and take decision concerning possibility of continuing education by the master's degree program.

"We can just add that if such an indicator as "employability competence" was introduced with respect to the university, it would help improving its competitiveness in the labor market" (Zadorozhnyuk, 2012).

4. Discussion

Transition to a two-tier education system caused restrictions on career growth of graduates with bachelor's degree. In June 2016, the Federal Law "On the civil service in the Russian Federation", Chapter 2, Article 12, paragraph 3 was amended as follows: "For vacancy filling of civil service position jobs in categories of "Heads", "Assistants (Advisers)", and "Specialists" of the highest and main groups of civil service position jobs, the availability of higher education not below the level of the specialist and master's degree is obligatory" (Federal'nyi zakon..., 2004).

In accordance with this amendment, a graduate, enrolled in the bachelor's degree program, cannot occupy policy-making post, thus the opportunity for his career growth is limited legally. As a result, to advance in a career, graduate with the bachelor's degree will need to enter the master's degree program (provided that the graduate of the bachelor's degree program has diploma with honors).

"Fulfilling life of people in the XXIst century will require more and more comprehensive education, far beyond the capabilities of secondary school. At that, it is not the labor market that should dictate the scale, diversity, quality, and effectiveness of education. They are determined by the whole logic of the need to build human potential, self-actualization of people as citizens, as parents, as cultural subjects, as well as by diversity of life, rather than just the economy (Plaksiy, 2014).

5. Conclusion

Since its inception, the Bologna Process has brought together 48 countries. However, many European countries have recognized the imperfection of the Bologna Process. Today the Russian diploma neither actually nor legally has force in Europe. Moreover, in April 2018, the UK has blocked the decision on mutual recognition of education documents with regard to Russia.

Since 2011, Russia has carried out the transition to a two-tier education system under the bachelor's and master's degree programs at higher education institutions. In turn, employers are still wary of graduates with bachelor's degree.

In this situation, the possibility of transition to targeted education and coordination of training programs with the business will be a necessary direction in the education reform, which will provide an opportunity to solve the employment problem of graduates of higher education institutions trained under the bachelor's degree program.

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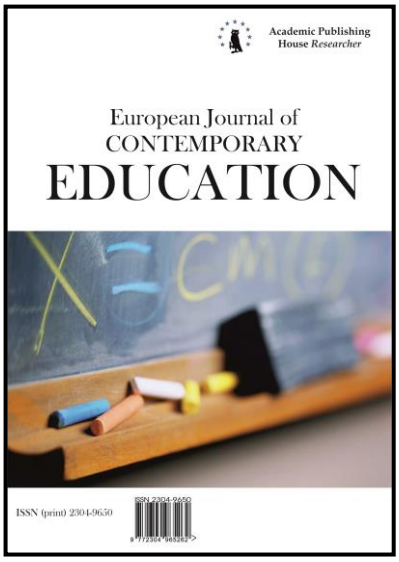
Published in the Slovak Republic
European Journal of Contemporary Education
E-ISSN 2305-6746
2018, 7(3): 521-530
DOI: 10.13187/ejced.2018.3.521
www.ejournal1.com



Internet Communication as a Factor of Psychological Challenges among Student Youth

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Abstract

Continuous surfing the Internet has become one of the students' lifestyle markers. Some modern researchers argue that as a result of long and regular Internet networking, young people sooner or later begin to experience psychological challenges. The analysis of international and Russian psychological studies on the issue of Internet communication has made it possible to identify the main personal challenges young people may deal with. The paper presents the results of an empirical study of psychological challenges facing by young people who resort to Internet communication. The study involved young people aged 18 to 22 years old, taking advantage of the Internet communication, 45 people in total. All of the subjects are students of various Russian universities. The empirical study has been conducted in the virtual interaction mode. The general hypothesis maintains that, taking into account the exponential growth of information in general, the Internet as a modern communication environment contributes to the emergence of psychological challenges at youth, in particular: manifesting negative emotional states (experiencing depression); reducing the level of self-confidence and self-esteem; generating uncertainty; and exhibiting symptoms of Internet addiction and formation of obsessive need to virtual communication. The study has showed that, representing a huge communication zone for people, the Internet has its pros and cons. Using various possibilities of the worldwide network leads to structural and functional changes in the mental activity of an individual.

Keywords: Internet communication, psychological challenges, student youth.

1. Introduction

Over the past decade, the role of the Internet as a channel of communication, through which both personal and business networking take place, has been increasing. Many social processes are reflected in the virtual space; the interaction of individuals in the Internet happens almost more

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often than in reality (communication in social networks, forums, personal and business correspondence by e-mail, etc.). As a communication channel the Internet has many advantages, among which there is efficiency, informativeness, accessibility, and ability to remain anonymous.

A.E. Voyskunskiy describes three basic types of needs that people meet using the Internet: communicative, cognitive and gaming (Voyskunskiy, 2002).

Communicative need is satisfied through using e-mail services, chats, forums, etc. A significant part of the modern social activity of young people is realized within the framework of interaction in Internet communities and, above all, social networking services such as *VKontakte*, *Odnoklassniki*, *My World*, and *Facebook*. Today more than 85 % of Internet users are registered in social networks. A typical user of social networks is a young person aged 18-24 years old (96 %). Russian Internet users actively take advantage of the network as a means for free expression of thoughts and feelings (Kulikova, 2018).

Cognitive need is provided by the web navigation tools, reading news and analytical reviews, searching for specific information or browsing the current news, remote education forms, and so on. Satisfaction of the cognitive need, i.e. the need for information – various websites, blogs, forums, diaries – allows us to obtain any information: for example, either official sites or travelogue posts. Using official sites and search engines, Internet users learn the news about events in the world, in their country, in their hometown. With the help of the software program "online translator" they can quickly translate any desired text from any international language into their native language and vice versa.

As for examples of meeting the gaming need, we can list individual and group games with a computer or with real partners via the Internet. The gaming need is provided by a wide range of games – from simple to complex scenario-based interactive gaming structures involving the participation of online communities. In fact, all services are games. Any social network itself is also a game. It defines rules for access to players, and there is a connection with real life.

Researchers of Internet networking usually divide ways to communicate on the Internet in terms of their interactivity. The most interactive communication media are messengers *WhatsApp*, *Viber*, *ICQ* and *MUDs*; the least interactive ones are e-mail services, guest books, forums and teleconferences. When posting on forums and e-mailing, communication occurs in the mode of a delayed response (offline) unlike chatting via the messengers *WhatsApp*, *Viber*, *ICQ* and *MUDs*, where people exchange their information in real time (online). Forms of network communication also differ in the number of users involved into the communication process (mono-, dia- and polylogue ones). Forum communication occurs on a certain topic matter, while chatting does not always have its own topic, and even if there is one, it is rarely observed (Kulagina, Tarasova, 2014).

Basic psychological studies on the Internet communication are aimed mainly at exploring types of communication, such as chats and forums (I.S. Shevchenko, I.V. Romanov, T.A. Naumova, I.V. Andreev, G.S. Chichkova, A.A. Meleshnikov, A.V. Kuznetsova). However, we are more interested in the psychological challenges of young people that arise as a result of a long and regular Internet communication.

The word "communication" comes from the Latin word *'communicatio'* that means '*message*' or '*transfer*'. S.V. Borisnev points out that communication should be understood as a process of transferring, receiving and assimilating information under conditions of group, personal or mass communication, determined by social circumstances, using various communication channels (Borisnev, 2003). Communication, mediated by a computer (electronic, computer, virtual, network, Internet-communication), is communicative interaction of people with the help of computer devices and networks (local, Internet, etc).

At the end of the last century, P. Wallace offered the term '*Internet psychology'* to refer to the range of scientific interests studying the psychological aspects of the activities mediated by modern information systems. The main research directions in this area are focused on studying the influence of Internet activity on the cognitive abilities of a person and studying the dependence on the Internet, or Internet addiction, intensively discussed in medical, psychological and pedagogical literature (Voiskunskiy, 2002).

The term '*Internet addiction'* proposed by Dr. A. Goldberg in 1996 describes uncontrollable, painful thrust to the Internet. Computer addiction is an issue that clinical psychologists deal with. K. Young starts the discussion on this topic in 1994 when puts a questionnaire on the site, which has resulted in the identification of 400 addicts out of 500 subjects. K. Young discovers that

Internet addiction is often associated with depression. Depressive patients who have difficulty with communication or social adaptation often resort to the help of the Internet to overcome the difficulties to interpersonally interact in reality (Young, 2000). It has been also found that the Internet-dependent often feel nervousness while being "offline", and students suffer from academic failure and deterioration of relations.

Later, researchers I. Goldberg, D. Greenfield, C. Surratt and others have been dealing with the Internet addiction (Shabalin, 2001).

Current research in neurophysiology, neuropsychology and genetics show that the risk of dependence formation is caused by insufficient activity of the dorsal part of the cerebral frontal medial cortex: metabolic disturbances of dopamine, which is part of the "reward curcuits" (Bridgett et al., 2015; Lynn et al., 2014; Berrige, Kringelbach, 2015). There is a differentiated predisposition to the development of various dependencies (Buckholtz et al., 2010). Computer game developers use neuropsychological (dopamine) mechanisms to help to keep the person in the game, for example, supporting the player in a constant state of pleasure anticipation resulting from the levels progress.

From a psychological point of view, to generate varying dependencies there should be originally dependent personality, tracing the genesis of which, you can delve into infant and early age (Bowlby, 1988). Thus the content of dependence (food, game or emotional) is a secondary phenomenon.

The social context with respect to various addictions is ambiguous: social perception of teenagers' alcoholization, smoking and misuse of drugs is unequivocally negative; there are legal and social mechanisms limiting the spread of these forms of addictions among young people. In relation to non-chemical dependencies, the society is more tolerant, which prevents the implementation of early prevention, and an obvious need for help arises when negative consequences for the individual are already critical.

For a person who is dependent on the Internet, the following behavioral reactions are inherent: "an active reluctance to get distracted even for a short time from web browsing; forgetting about household chores, studies or job duties, important personal and business meetings while web browsing; unwillingness to accept criticism of such lifestyle; preparedness to put up with the destruction of the family, the loss of the social circle due to the Internet absorption; neglecting their own health, reduction of the sleep duration; preparedness to be satisfied with random and monotonous food irregularly swallowed up with full concentration on the computer screen..." (Pokrovskiy, 1989). The constant use of a computer leads to a person's stressful state. No less significant is the fact that the non-systematic use of computers damages the social, psychological and interpersonal status of an individual (Morozova, 2010).

American psychologists at Carnegie Mellon University have conducted a study, the results of which showed that the more time Internet users spend on the Net, the more they are exposed to emotional disturbances. According to the researchers, information overload can be an obvious cause of stress (Kulikova, Maliy, 2015).

J. Suler emphasizes the effect of deliverance, within which two options are possible: to release negative emotions and satisfaction of destructive needs (insulting others, hacking websites) or to realize the possibility to be frank and not to close in some very personal aspects (Suler, 1996).

Online communication is very attractive. The following advantages for youth exist: there is no evaluation of the partner according to external data; there is no need to quickly form a thought; it is possible to communicate "on behalf of other person". Such communication may even bring a person to a new level (Ovcharova, 2000). Though, everything is good in moderation. When this excessive passion develops into an addiction, it leads to negative effects on the mental and physical life of a person.

Conducted by S. Filippova and E. Shelispanskaya, research showed a high severity of psychological distress, a tendency to neurotic states: obsessive-phobic, anxious, depressed. The presence of the expressed neurotic tendencies are found in *more* than half of the participants in the experiment. It was found that psychological well-being is related to the perception of the body: neurotic girls identified anxious-obsessive tendencies towards their own corporeality. The authors emphasize that the excessive fixation of female students on the problem of corporeality is due to the influence of the information environment: in particular, the importance of Internet communication in the life of modern youth (Filippova, Shelispanskaya, 2017). What is

typical for them that is the need for self-presentation in the network bordering on narcissism, the need to follow fashionable trends (diet, fitness, body modifications) with a low degree of awareness of personal motives and life goals.

2. Materials and methods

All of the above mentioned defines the objective of our study that is to empirically identify and classify psychological challenges of young people using the Internet as a means of communication. We consider the psychological challenge as a psychological contradiction within the personality, which does not violate the mental norm, but creates discomfort, tension, complicates the functioning and adaptation of the individual. The empirical basis of the study involves young people aged 18 to 22 years old, taking advantage of the Internet communication, 45 people in total. All of the subjects are students of various Russian universities. The topical case study has been conducted in the virtual interaction mode.

We assume that there are causal relationships between the time students spend on the Internet, the types and severity level of psychological challenges, in particular: manifesting negative emotional states (experiencing depression); reducing the level of self-confidence and self-esteem; generating uncertainty; exhibiting symptoms of Internet addiction and formation of obsessive need to virtual communication.

Theoretical and methodological basis of the study are as follows:

–theoretical approaches to understanding structure and nature of the communication process (B.G. Ananyev, G.M. Andreeva, A.A. Bodalev, V.N. Myasishchev, A.V. Petrovskiy);

–theoretical concepts of the factors determining the nature of communication, and the possibilities for enhancing the success of communication (E. Berne, R. Bandler and J. Grinder, Ch. Teutsch and J. Teutsch);

–theoretical approaches to define specific features of Internet communication, patterns of interaction in virtual space (A. Burova, A. Zichkina, V. Nesterov and E. Nesterova).

Analyzing international and Russian psychologists' research works makes it possible to identify the main personal challenges of young people who resort to Internet communication, and determines the choice of diagnostic techniques:

–depression scale (adaptation by T.I. Balashova). The questionnaire is developed for differential diagnosis of depressive states and conditions close to depression for screening diagnostics in mass studies and for preliminary diagnostics;

–test-questionnaire on self-conception (V.V. Stolin). As a starting point, it makes a distinction between the content of the "Self-image" (self-knowledge or self-image, including in the form of evaluating the certain features manifestation) and self-relation;

–test on self-confidence (V.G. Romek). The test responds to an understanding of confidence as a stable generalized positive attitude toward one's own skills and abilities (including their effectiveness);

–questionnaire on attitudes towards the Internet (E. Gubenko). The questionnaire can be used to measure the overall indicator (common scale) of the problematic use of the Internet.

When choosing the methods, we have tried to take into account the positive evaluation of the applicability and reliability of the methods, according to a number of international and Russian researchers; accessibility of methods for the study participants; possibility of a qualitative and quantitative analysis of the results obtained.

3. Results and discussion

To determine the time students spend on the Internet, we conducted a survey of respondents about how much time they spend on the Internet-communication on weekdays and at the weekend. The results of the survey are presented in the Figure 1.

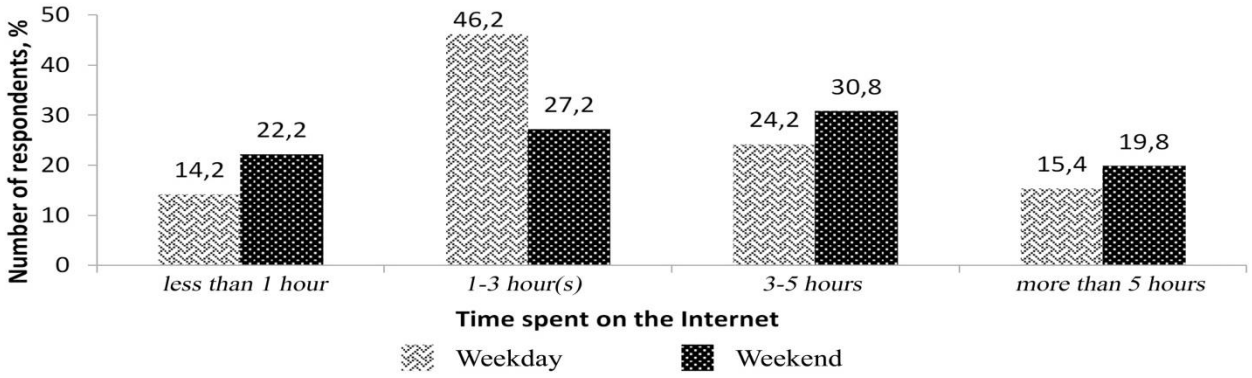

Fig. 1. Respondents' distribution by time spent on the Internet

According to the respondents' "confessions", the student youth spends a significant part of their "useful" time on the Internet. The majority of respondents (46.2%) indicate that on weekdays they spend on an average one to three hours per day on the Internet. Almost 15.4% of students communicate chatting online more than five hours a day. On weekends, as a rule, the amount of time spent on the Internet increases. It is established that 30.8% of students devote from 3 to 5 hours to the Internet on Saturday and Sunday (or on holidays). 19.8% of the respondents are online more than five hours a day.

According to the results of the method "Depression scale" (adaptation by T.I. Balashova), it is found that 36.2% of the participants in the general sample of young people have a state without depression / low level (average coefficient of feature severity is 3.0 stens), whereas the average and high levels are detected in 35.2% and 28.6% of participants, respectively, with feature severity 4.0 and 7.0 stens. We consider the average level as a depressive state, which can be expressed by episodes of hypothymia and apathy. The results show that relaxation, self-assurance, and all other positive reactions occur only during their time on the Internet. When young people return to the real world with all its conflicts, experiences and challenges, they are overcome by despondency and depression.

According to the results of the method "Test-questionnaire on self-conception" (V.V. Stolin), we have found out that in the group of subjects there are no respondents with a low level of global self-realization, that is, the respondents have not revealed a negative attitude towards themselves. The prevalent number of subjects has a pronounced favorable attitude to their "Self" and is aware of its value. This indicator correlates with the level of self-esteem. Nevertheless, it has been revealed 30.8% of respondents with low self-esteem in the group (average coefficient of feature severity is 2.0 stens), which indicates an internal conflict between the real and ideal "Self". The level of self-esteem determines the success of an individual and his or her level of happiness. A high level of self-esteem leads to success, as well as to high achievements in all spheres of life, and, conversely, a low level of self-esteem precedes many disappointments and failures.

According to the test by V.G. Romek, self-confidence level results indicate that low rate on the scale of "self-confidence" has been revealed at 35.2% of the respondents among the subjects (average coefficient of feature severity is 2.0 stens). Despite the fact that excessive self-confidence is often not encouraged by young people, low scores determine the inability of test subjects to make complex decisions on their own, to independently control their actions and their results.

Low rate on the scale of "social courage" has been identified at 40.6% of the subjects (average coefficient of feature severity is 2.0 stens). Social courage consists of such components as social intelligence, self-confidence, and ability to take risks. In order to show social courage people need to overcome fear by their willful action. Therefore, the constituent elements of the manifestation of social courage are fear, will and willingness to act (Esaulova, 2017). Acting as a certain psychological barrier, fear restrains a person without allowing a certain action to be performed; and courage manifests itself in the fact that, despite feeling the fear, we can perform the action.

In the context of this study, it should be said that subjects with a low score on this scale experience difficulties in real communication, they are much less likely to enter social contacts, and virtual communication seems to them as an alternative to face-to-face communication (Karpova,

2013). Social perception in the network interaction can be distorted under the influence of conscious manipulation of users with a certain reputation (image adjustments, exaggeration of achievements). Thus, through the Internet, a distorted reality is created, which is broadcast to the individual consciousness; the state of psychological distress is the result of dissonance when comparing the real "Self" with networked self-presentations. Fear of nonconformity forces them to become isolated in themselves, avoiding social contacts, and also to imitate the desired image in the network.

The Internet makes it possible to create an alternative and rather safe environment in which the person is deprived of frustrating factors, and, consequently, the need for development. In some ways the Internet performs the functions of psychological defenses, contributing to the displacement, avoidance, substitution, denial and other forms of avoiding contact with real conflicts and difficulties.

The results of the questionnaire on attitudes towards the Internet (E. Gubenko) allow us to state that 12.0% of the subjects tend to use the Internet to achieve social comfort, i.e. to have the opportunity to communicate with other people and develop their own social network, as well as to achieve a feeling of peace and security due to belonging to a virtual social environment, even though it is virtual (average coefficient of feature severity is 3.0 stens).

It should be noted that high indicators on a scale of "social comfort" show a lack of subjects' faith in their forces (61.6%), an underestimation of their capabilities, including those in the field of interpersonal communication (average coefficient of feature severity is 9.0 stens). Such people are largely characterized by a low ability to control their own lives, to make responsible decisions and to understand themselves.

High level of the rate on the scale "loneliness" (average coefficient of feature severity is 7.0 stens) in a subjects group (30.8%) indicates the feeling of loneliness in the real world and, as a result, involvement into virtual communication as a way to supplement the deficit of interpersonal communication in real life.

In 26.4% of the subjects, low level of self-control has been revealed (average coefficient of feature severity is 3.0 stens), i.e. the inability to control one's behavior in the context of the conflicting social environment influence, in particular, exposure to impulsive outbursts and strong dependence on external influences, which shows the involvement of young people in the active use of the Internet as a means of networking and communication.

For the convenience of interpreting the data obtained during our experiment, we present the results in the summary Table 1.

Table 1. Summary table of subjects' distribution by levels of the analyzed indicators

Subjects indicators	Subjects distribution by levels, in %		
	high	average	low
Depression	28.6	35.2	36.2
Self-esteem	42.8	26.4	30.8
Self-confidence	26.4	38.4	35.2
Social courage	24.2	35.2	40.6
Social comfort	61.6	26.4	12.0
Loneliness	30.8	42.8	26.4
Self-control	35.2	38.4	26.4

In order to establish the focus and tightness of the correlation between the signs of psychological challenges at student youth, the R-Pearson correlation was performed; the calculation was carried out using the software program *Statistica*. For the convenience of interpreting the data obtained during our experiment, we present the results in the Table 2.

Table 2. Correlation matrix of signs of student youth's psychological challenges (level of statistical significance $p < 0.05$)

Symptoms	*D*	*SE*	*SC*	*SCr*	*SCmf*	*L*	*SCtr*	*Ii*
Depression (D)	×	-0.42	**-0.79**	0.12	**0.79**	**0.64**	**-0.60**	**0.64**
Self-esteem (SE)		×	**0.57**	0.47	**0.55**	-0.33	0.40	**0.55**
Self-confidence (SC)			×	**0.70**	0.33	0.16	0.30	0.40
Social courage (SCr)				×	0.44	**0.57**	0.33	**0.57**
Social comfort (SCmf)					×	**0.57**	**-0.64**	-0.44
Loneliness (L)						×	0.26	**0.57**
Self-control (SCtr)							×	**0.55**
Integral indicator (Ii)								×

Analyzing data in Table 2, we can see certain causal relationships between the investigated individual symptoms of psychological challenges among student youth. First of all, there is an inverse correlation between the state of depression and loneliness experiencing. The correlation coefficient in this case is $\boldsymbol{r} = 0.64$.

Also there is a direct relationship between criterion of social comfort and the level of social courage ($\boldsymbol{r} = 0.71$). Thanks to the Internet, they do things that they would have never decided in real life. According to the study by T.V. Kondrat'yeva, young people experience psychological discomfort – a "computer hunger", if at least one day they do not have access to a computer (Kondrat'yeva, 2000).

We should also highlight a direct relationship between criterion of self-confidence and criterion of social courage ($\boldsymbol{r} = 0.70$). Confirmation of this fact can be found in a comparative study of the modification of the lifestyle of the Russians, conducted under the leadership of A.A. Vozmitel', a leading Russian scholar in the field of lifestyle research. It has turned out that the percentage of 'microenvironments' in which all people are confident in the future has decreased by 8 times (compared with the Soviet period). The proportion of microenvironments consisting of compassionate people has reduced by 40%. On the contrary, an amount of people have increased by more than 4 times, in the immediate surroundings of whom all are concerned solely with personal well-being (Vozmitel', Osadchaya, 2010). The general vector of changes shows that "better to work" is gradually replaced by "better to consume".

To establish the tightness of the correlation between the time students spend on the Internet and signs of psychological challenges, Pearson's pair correlation was also calculated (Figure 2).

As a result of determining the tightness of the correlation between the time students spend on the Internet and signs of psychological challenges, the following has been established:

1) there is a strong direct correlation between the time spent on the Internet (**T**) and the integral indicator of students' psychological challenges (**Ii**), namely, the *more* time students spend on Internet communication, the *more* their psychological challenges become more evident. The correlation coefficient in this case is $\boldsymbol{R} = 0.75$ at $\alpha = 0.05$, SEM = 0.19, CI = (0.64, 1.38), which indicates a strong correlation;

2) there is a strong direct correlation between the time spent on the Internet (**T**) and the sense of depression (**D**) and experiencing loneliness (**L**). In the first case, the correlation tightness is $\boldsymbol{R} = 0.47$ at $\alpha = 0.05$, SEM = 0.19, CI = (0.39, 1.22), and, in the second one, it is $\boldsymbol{R} = 0.53$ at $\alpha = 0.05$, SEM = 0.19, CI = (0.39, 1.08);

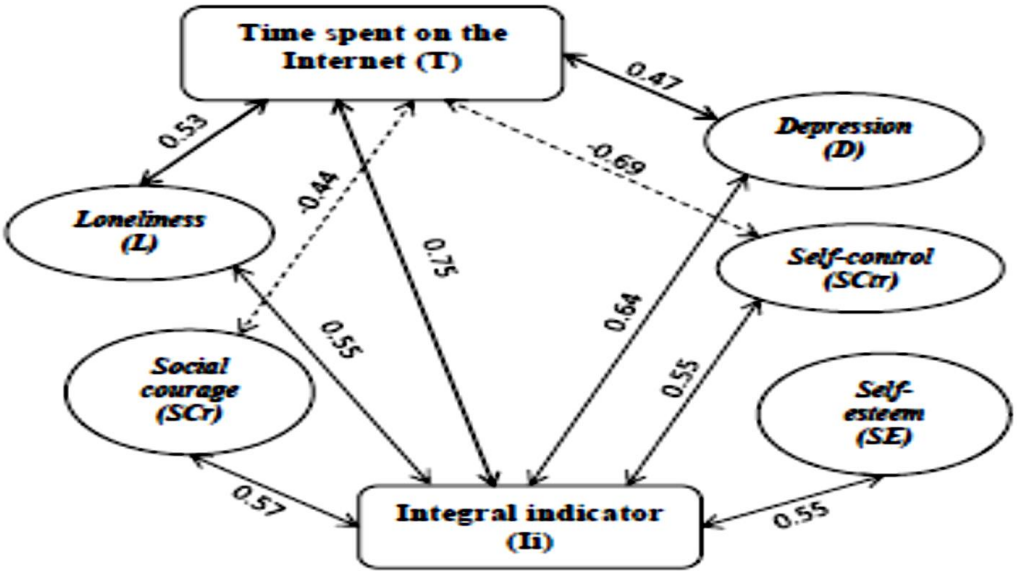

Fig. 2. The tightness of the correlation between the time students spend on the Internet and signs of psychological challenges (*level of statistical significance p<0.05*)

3) there is an inverse correlation between the time spent on the Internet (**T**) and the criteria of social courage (**SCr**) and self-control (**SCtr**). The correlation coefficient in the first case was ***R*** = -0.44 at α = 0.05, SEM = 0.19, CI = (0.35, 1.2), and in the second case, ***R*** = -0.69 at α = 0.05, SEM = 0.19, CI = (0.48, 1.13).

4. Conclusion

The data obtained in the course of the empirical study make it possible to draw conclusions that the subjects:

–have the tendency to experience depression;

–lack in the ability to make serious decisions, to take responsibility for their own life;

–show low self-confidence, which indicates difficulties in communication in real life;

–note the feeling of loneliness in real life and, as a result of it, large engagement in the process of active use of the Internet as a way to communicate, including making acquaintances, coupled with the presence of obsessive thoughts about the Internet.

During the theoretical analysis of psychological literature on the issue of Internet networking and communication, the main approaches to studying communication challenges and basic definitions of communication have been identified. It has been concluded that communication is an important factor to form a mature personality, in particular, in the period of early adolescence. The study has showed that young men and women who prefer virtual communication demonstrate a high level of depression and situational anxiety; their self-esteem is significantly understated; the ability to independently make important decisions in their lives and responsibility for their results is not sufficiently formed; subjects who choose the Internet as the main means of communication do not understand enough the connection between their actions and significant events in life, do not consider themselves capable of controlling their development and believe that most of these events are the result of an accident or other people's actions.

Thus, it is possible to say that the Internet is a phenomenon of social reality, which has its pros and cons. In addition to the vast amount of information, the Internet is a huge area for people to communicate. Internet communication has its specific features and characteristics. Using various possibilities of the worldwide network leads to structural and functional changes in the mental activity of the individual.

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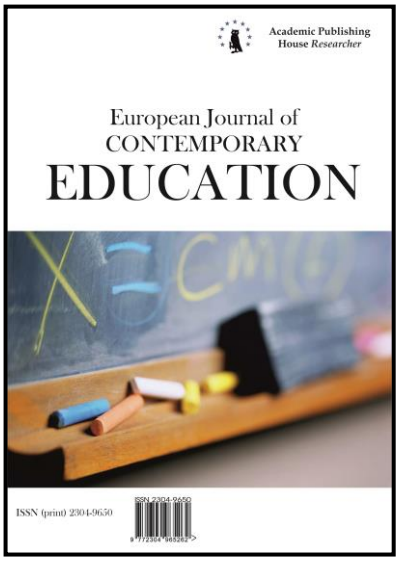
Published in the Slovak Republic
European Journal of Contemporary Education
E-ISSN 2305-6746
2018, 7(3): 531-540
DOI: 10.13187/ejced.2018.3.531
www.ejournal1.com



Investigation of the Relationship between Teaching and Learning Conceptions and Epistemological Beliefs among Student Teachers from Hashemite University in Jordan

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Abstract

This study aimed to analyzing the relationship between student teachers teaching and learning conceptions and epistemological beliefs. The study sample is composed of 250 undergraduate student teachers attending the faculty of Educational Science. The Conceptions of Teaching and Learning Questionnaire (CTLQ) and Epistemological Beliefs Scale (EBS) were the sources of data collection. The study results showed significant gender-based differences in teaching and learning conceptions based on student teachers' gender. A significant relationship was also found between student teachers' teaching and learning conceptions and their epistemological beliefs.

Keywords: teaching and learning conceptions, epistemological beliefs, student teachers.

1. Introduction

Gaining an insight into the learning and teaching conceptions held by teachers may well be of interest to both teachers and educational institutions. Since the teachers' conceptions are not wholly the result of conscious decisions, encouraging them to reflect deeply may trigger responses engendering modification of the conceptions (Ho; Watkins, Kelly, 2001). From the institute's perspective, such an overview could be a valuable data resource if, for instance, curricula were under review and likely to become more student-centered. Teachers' conceptions of teaching and learning are defined by Chan and Elliott (2004) as "the beliefs held by teachers about their preferred ways of teaching and learning" (p. 819) including what teaching and learning actually mean, and the teacher-pupil relationship.

The two distinct and opposing conceptions in teaching and learning are known as the traditional and the constructive, the traditional conception being based on teacher-centered methods where he/she is the knowledge source and the student merely the passive recipient.

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The theories propounded by Piaget and Vygotsky form the basis of the Constructivist conception, which is diametrically opposed to the Traditional, in stressing the significance and value of active, practical experience and participation by the learner in his/her knowledge-building, and the positive impact of a child's interaction with peers or adults is stressed by both Vogostsky and Miller (1997).

Therefore, the basic tenets of constructivism are as follows: the child is not a passive recipient of knowledge, but an active participant in his/her knowledge-building, physically and intellectually, contributing meaningfully and positively by assimilating and incorporating new knowledge with that already held. According to Clements and Battista (1990), each individual's conception of the world is inevitably based on his/her childhood environment, social interaction, and life experiences, which all contribute to the view of learning as a social process whereby the child's intellectual growth may be either stimulated or stunted by the intellectual environment. This is in direct contrast to constructivism, which is centered on developing critical thinking and an ethos of cooperation and teamwork, where the learning environment is stimulating and pro-active (Chan, Elliot, 2004; Cheng et al., 2009).

There is an abundance of literature examining the various ways in which teachers and students view learning, the studies undertaken for a variety of reasons and purposes, but according to Chan, Tan, and Khoo (2007), Meirink, Meijer, Verloop, and Bergen (2009), Saban (2003), Saban, Kocbecker, and Saban (2007), many are conducted on the basic premise that teachers' beliefs regarding teaching and learning conceptions are two distinct subjects which can be considered separately, without the one having any bearing on the other.

The primary focus of studies by Saban (2003) and Saban et al. (2007) for example, is the beliefs held by teachers regarding teaching while relegating their beliefs regarding learning to a mere offshoot of the research.

On the other hand, the deep layers of teacher cognition have become the focus of abundant studies oriented toward its psychological aspects, initially investigating the epistemological beliefs of teachers and correlating them with the teachers' actual teaching behavior, which is revealed in many studies to be their prime concern (Chai et al., 2009; Hofer, Pintrich, 1997; Maggioni, Parkinson, 2008; Wong et al., 2009). However, as noted by Hofer and Pirnrich (1997) our understanding of students' and teachers' beliefs, thoughts, and thinking about knowledge will be advanced by exploration of developing epistemological theories, which aid greater comprehension of the complex process of teaching and learning in classrooms.

Researchers have long been aware of the popularity of student teachers' conceptions of learning and teaching as a study topic, due in no small measure to its impact on not only learning strategies and outcomes, but also on students' motivation. Studies by Pillay, Purdie & Boulton-Lewis (2000), Purdie and Hattie (2002), Purdie, Hattie and Douglas (1996), also illustrate the effect of these conceptions on learning outcome quality.

Another popular topic creating an abundance of studies is the exploration of consistency between teachers' approaches to teaching and their teaching and learning conceptions (Chan et al., 2007; Hewson, Kerby, 1993; Koballa et al., 2005) while other researchers have identified specific attributes attached to these conceptions such as being nested (Koballa et al., 2000; Tsai, 2002), culture dependent (Chan et al., 2007; Tsai, 2004), domain-specific (Eren, 2009; Tsai, 2004), and suggested relationships including those with epistemological beliefs (Chan, Elliott, 2004; Otting et al., 2010) and self-efficacy beliefs (Eren, 2009).

A number of cognitive variables can impact the processes of both teaching and learning, among the most important of which are epistemological beliefs and teaching and learning conceptions. Epistemological beliefs are defined as expressions of belief in the nature of knowledge and its acquisition or learning. A definition of personal epistemological belief is given by Schommer, who describes it as a five-dimensional system (knowledge organization, certainty of knowledge, source of knowledge, control and speed of knowledge acquisition) whereby each dimension may be used individually or in combination, with these beliefs exerting a strong influence on both individual and general cognitive and meta-cognitive thought processes (Schommer, 1990, 1994).

According to Chan and Elliot (2004), Cheng, Chan, Tang and Cheng (2009), recent studies have illustrated a mutual effect between epistemological beliefs and teaching and learning conceptions, whereby each is influenced by the other. As explained by Schommer (1990, 1994),

epistemological beliefs can be regarded as individual traits, since they reflect a person's particularities relating to the nature and acquisition of knowledge. While Hofer (2001) regards epistemological beliefs as comprising the following when defining knowledge: its construction, method of evaluation, where it is based, and how it transpires.

Although epistemological beliefs may be considered a unit or entity, they do at the same time comprise a belief system with five independent dimensions, including such as: the source of knowledge, its structure/organization, its stability, and speed and control of learning (Schommer, 1990) notes that the differing individual levels of epistemological beliefs are related to the individual's level of sophistication, worldliness, educational background etc., therefore an educated person is more likely to believe that knowledge is neither certain nor absolute, that it is neither perfect nor complete, that an unknown mass has yet to be discovered, and that only a small portion of it is constant. Such individuals will naturally bring a critical approach to what they read, whereas the epistemological beliefs of those from a more limited background will be naïve, believing most knowledge to be assured and constant, that some knowledge will be of recent discovery, but that the main body of knowledge is immutable, consequently these individuals are credulous and gullible, believing and being influenced by whatever they read (Aypay, 2011a; 2011b; Deryakulu, 2002; Schommer, 1990, 1994).

Schommer (1990) purport that the differences in individuals' epistemological beliefs will therefore impact their success and achievement particularly in the academic field, since those with a background in critical thinking and evaluation of knowledge, familiar with time-management, prioritizing, and other learning/study strategies will be more aware of the extent to which they are absorbing and understanding the new knowledge.

A number of researchers including Brownlee, Purdie & Boulton-Lewis, (2001), Hofer and Pintrich (1997), Tolhurst (2007), pinpoint the ways in which epistemological beliefs influence variables, such as individuals' methods of handling the new knowledge, levels of comprehension, interpretation, use of inference and deduction, study strategy choices, thought processes and problem-solving, and the time and effort expended in learning. Additionally, Hofer and Pintrich, (1997, 2002), provide insight into epistemological beliefs as a branch of philosophy dedicated to exploring the spectrum of human knowledge, its origin, nature, methods and limits. The importance of these beliefs lies in their broad sphere of influence, since they are core values or concepts whose function is associated with the majority of beliefs and knowledge. In his study, Perry (1970)presents the hypothesis that during development of students' epistemological beliefs, they progress through definite strata: (1) dualism, (2) multiplism, (3) relativism, and (4) commitment. Schommer (1994) presented an expansion of Perry's work and illustrated four dimensions within four perspectives of epistemological beliefs, ranging between naïve and sophisticated.

The beliefs of higher-scale, sophisticated learners accept that a minimal amount of knowledge is invariable, some knowledge is yet to be revealed, and an immense body of knowledge is evolving. These beliefs are in direct contrast to those of naïve learners, that an immense body of information is certain, some knowledge remains to be discovered, and a minimal amount of knowledge is changing.

The purpose of the present research is to perform an analysis of the correlations between student teachers' epistemological beliefs and their teaching and learning conceptions in the Jordanian higher education context.

Study questions

This study aimed to answer the following questions:

Questions One: What are the teaching and learning conceptions and epistemological beliefs held by the student teachers?

Question Two: Are there any significant differences in teaching and learning conceptions of student teachers based on gender?

Questions Three: Is there a significant relationship between teaching and learning conceptions and epistemological beliefs?

2. Study Methodology

Participants

The participants consisted of 250 student teachers at the Faculty of Educational Science, Hashemite University. Of the participants, 66 were male (26.4 %) and 184 female (73.6 %). Of the student teachers 66 (26.4 %) were first year, 58 (23.2 %) second year, 39 (15.6) third year, and 87 (34.8) fourth year, participants' ages ranging from 18 to 22 years (M=20.12; SD=2.66).

Data collection tools

In the current study, two data collection tools were used: Teaching and Learning Conceptions Questionnaire (TLCQ) which was developed by Chan and Elliot (2004), includes 30 items measuring two different conceptions, teaching and learning. The first conception, constructivist method comprises 12 items, and traditional method 18 items. The TLCQ was scored on a five point Likert scale ranging from (1) never to (5) always. Chan and Elliot (2004) calculated that the internal consistency of the questionnaire using Cronbach alpha was 0.84. For the purpose of the current study, the questionnaire was translated into the Arabic language and referred to three faculty members for language accuracy verification. The author calculated that the internal consistency of the questionnaire using Cronbach alpha was 0.85 for constructivist conception, and 0.81 for traditional conception.

The second tool was the Epistemological Beliefs Scale (EBS) which was developed by Chan and Elliot (2004), includes 30 items measuring four subscales for epistemological beliefs (1) innate/fixed ability (13) items, (2) learning effort/process (6) items, (3) authority/expert knowledge (6) items, and (4) certainty knowledge (5) items. The EBS was scored on a five point Likert scale ranging from (1) strongly disagree never to (5) strongly agree. Chan and Elliot (2004) calculated the internal consistency of the instrument using Cronbach alpha was 0.84. For the purpose of the current study the scale was translated into the Arabic language and referred to three faculty members to check for language accuracy. The author calculated the internal consistency of the instrument by using Cronbach alpha was 0.82, 0.85, 0.77, and 0.81 for innate/fixed ability, learning effort/process, authority/expert knowledge, and certainty knowledge respectively.

The participants answer the Teaching and Learning Conceptions Questionnaire (TLCQ) and Epistemological Beliefs Scale (EBS) during approximately 40 minutes of their regular class time.

Data analysis

The mean and standard deviation for each of the subscales of teaching and learning conceptions and epistemological beliefs were obtained. Independent sample t-test was used to determine whether there are a significant differences in the subscale of teaching and learning conceptions based on gender, the t-test determine whether there is a significant differences between the means in two unrelated groups, the Pearson correlation coefficient was used to determine whether there is a significant relationship among the subscales of teaching and learning conceptions and epistemological beliefs, and multiple regression analysis was used to show the predictability of epistemological beliefs to teaching and learning conceptions. The SPSS (v. 20) was used for all these statistical procedures.

3. Results

***Question One*:** What are the teaching and learning conceptions and epistemological beliefs held by the student teachers?

To achieve this objective, illustrative statistics including means and standard deviation were used to explain the student teachers teaching and learning conceptions. Table 1 presents means and standard deviation for each dimension.

Table 1. Means and standard deviation of teaching and learning conceptions

Dimensions	Means	Standard Deviation
Constructivist Conception	3.43	0.99
Traditional Conception	3.04	0.67

The results showed mean scores of student teachers' teaching and learning conceptions ranging from 3.04 to 3.43. Constructive conception dimensions had the highest mean value (M=3.43, SD= 0.99), followed by traditional conception (M= 3.04, SD=0.67).

To determine the means of each dimensions of epistemological beliefs, Table 2 presents means and standard deviation for each dimension.

Table 2. Means and standard deviation of epistemological beliefs

Dimensions	Means	Standard Deviation
Innate/Fixed Ability	2.87	0.57
Learning Effort/Process	3.33	0.83
Authority/Expert Knowledge	2.92	0.63
Certainty Knowledge	3.04	0.86

The means scores and standard deviation were used to explain the student teachers' epistemological beliefs. The results showed that the mean scores of student teachers' epistemological beliefs ranging from 2.87 to 3.33. Learning effort/ process dimensions had the highest mean value (M=3.33, SD=0.83), followed by certainty knowledge (M=3.04, SD=0.86), and then by authority/expert knowledge (M=2.92, SD=0.63). The lowest mean scores wherefore the innate/fixed ability (M=2.87, SD=0.57).

***Question Two**:* Are there any significant differences in teaching and learning conceptions of student teachers based on gender?

To determine whether significant differences exist between student teachers' teaching and learning conceptions according to student gender. Table 3 presents t-test, means and standard deviation for each dimension.

Table 3. t-test results of teaching and learning conceptions based on gender

Dimensions	Gender	Mean	S.D	t	Sig
Constructivist Conception	Male	2.59	0.87	-9.289	0.00
	Female	3.74	0.84		
Traditional Conception	Male	2.77	0.83	-3.846	0.00
	Female	3.14	0.58		

The results showed significant differences student teachers' gender in teaching and learning conceptions. For the constructive conception dimension, female students' mean score (M=3.74, SD=0.84) was higher than that of male students (M=2.59, SD=0.87), and for the traditional conception dimensions the female students' mean score (M=3.14, SD=0.58) was higher than that of male students (M=2.77, SD=0.83). The t value of the constructivist conception was (-9.298), and the t value of traditional conception was (-3.846).

Question Three: Is there a significant relationship between teaching and learning conceptions and epistemological beliefs?

To answer this question, Pearson correlation coefficient was used between teaching and learning conceptions and epistemological beliefs. Table 4 provides the detailed results of this correlation analysis.

Table 4. Correlation matrix of teaching and learning conceptions and epistemological beliefs

Dimensions	**1**	**2**	**3**	**4**	**5**	**6**
Constructivist Conception	1					
Traditional Conception	0.64*	1				
Innate/Fixed Ability	0.58*	0.72*	1			

Learning Effort/Process	0.79*	0.66*	0.68*	1		
Authority/Expert Knowledge	0.55*	0.69*	0.74*	0.64*	1	
Certainty Knowledge	0.56*	0.71*	0.62*	0.66*	0.62*	1

(1 – Constructivist Conception, 2 – Traditional Conception, 3 – Innate/Fixed Ability, 4 – Learning Effort/Process, 5 – Authority/Expert Knowledge, 6 – Certainty Knowledge).
*(P<0.01)

The results showed a statistically significant relationship between teaching and learning conceptions and epistemological beliefs. The Pearson correlation value ranges from0.55 to 0.79 between constructive conception and dimensions of epistemological beliefs, and the Pearson correlation value ranging from 0.66 to0.72 between traditional conception and dimensions of epistemological beliefs.

Multiple regression analysis:

Table 5 shows the results of the stepwise regression analysis using epistemological beliefs as predicted teaching and learning conceptions.

Table 5. Hierarchical regression of epistemological beliefs and teaching and learning conceptions

Epistemological beliefs	Teaching and learning conceptions	R	R^2	F	β	T	sig
Innate/Fixed Ability					.584	11.328	0.00
Learning Effort/Process					.792	20.452	0.00
Authority/Expert Knowledge	Constructivist Conception	0.795	0.633	105.555	.556	10.536	0.00
Certainty Knowledge					.563	10.720	0.00
Innate/Fixed Ability					.728	16.713	0.00
Learning Effort/Process	Traditional Conception	0.814	0.663	120.686	.662	13.905	0.00
Authority/Expert Knowledge					.691	15.043	0.00
Certainty Knowledge					.715	16.109	0.00

As shown in Table 5, the results indicate that the epistemological beliefs are significant predictors of constructivist conception: R^2 =0.633, F =105.555, P<0.005. These results were supported by the close to moderate correlation between four variables (r=0.795), approximately 63.3 % of the variance in student constructivist conception was accounted for by epistemological beliefs. Epistemological beliefs are significant predictors of traditional conception: R^2 =0.663, F = 120.686, P<0.005. These results were supported by the close to moderate correlation between four variables (r= 0.814), approximately 66.3 % of the variance in student traditional conception was accounted for by epistemological beliefs.

4. Discussion

There have been many past studies covering a wide range of cultural and academic contexts, to examine the factors contributing to the relationship in higher education institutions between teachers' instructional practice, and their teaching and learning conceptions and epistemological beliefs. This present study is an investigation into the teaching and learning conceptions and epistemological beliefs of undergraduate student teachers in the Jordanian higher education context.

The results of question one showed that the constructive conception dimension had the highest mean value (M=3.43), followed by traditional conception (M=3.04), while the epistemological beliefs learning effort/process dimensions had the highest mean value (M=3.33), followed by certainty knowledge (M=3.04), and then by authority/expert knowledge (M=2.92). The lowest mean scores for the innate/ fixed ability (M=2.87).

The results of question two showed that there are significant differences in teaching and learning conceptions based on student teachers' gender. For the constructive conception dimensions female students' mean score (M=3.74) was higher than of male students (M=2.59) and the t value was (-9.289). In other words, that there was a statistically significant difference between male and female student teachers' with respect to constructive conception dimensions of teaching and learning conceptions, in favor of the female students, who held more sophisticated beliefs about constructive conception than their male counterparts. This means that female students' beliefs about learning provides them with ample opportunities to explore, discuss and express their ideas, demonstrating that good teachers always encourage students to think and find answers for themselves. For the traditional conception dimensions the female students' mean score (M=3.14) was higher than that of male students (M=2.77) and the t value was (-3.846). In other words, there was a statistically significant difference between female student teachers and their male counterparts with respect to traditional conception dimensions of teaching and learning conceptions, in favor of female students, due to their more sophisticated beliefs about traditional conception than male students. This illustrates that female students' beliefs about learning is based on students remembering what the teacher has taught, and see the major task of teachers as the passing on of knowledge and information.

The results of question three showed positive significant relationship between all subscales of the teaching and learning conceptions and all subscales of the epistemological beliefs. This is an indication that the mean scores of both teaching and learning conceptions and epistemological beliefs were increasing concurrently. Green (1971), postulates that the organization of these conceptions into isolated clusters consequently permits the clustering of central beliefs.

The fact that this present study illustrates the student teachers holding teaching and learning conceptions as well as epistemological beliefs simultaneously, lead the researcher to expect their formation into a coherent network, the phenomenon explained by Green's explanation of the contradictory beliefs cluster.

A study by Chan and Elliot (2004) indicates the possibility of epistemological beliefs influencing learning conceptions, while Sheppard and Gilbert (1991) also found that conceptions about learning and the development of learners' epistemological beliefs may be influenced by both the teachers' theories of teaching, and the perceptions of learners with regard to learning approaches.

The findings demonstrated by the present study indicate the possibility of a causal relationship linking the three dimensions of epistemological beliefs: learning effort, expert knowledge and certainty of knowledge, and their influence on conceptions of teaching and learning, and indicate that students who evaluate their personal learning efforts and expertise positively and are less teacher-dependent, hold constructivist conceptions of teaching and learning, whereas those students believing in the certainty of knowledge and reliant on teacher expertise tend to hold traditional conceptions of teaching and learning.

The Hashemite University practices a constructivist philosophy of education consistent with the significant relationships that we have established between the learning/effort process dimension of the epistemological beliefs and constructivist conception of teaching and learning. This concept appears to be recognized and appreciated by the student body awareness of the great importance our university attaches to self-directed and collaborative learning, and the advantages of focusing on solving authentic tasks in a problem-based learning environment.

In their study, Hofer and Pintrich (1997), explain that individual beliefs concerning the nature of knowledge and the nature of knowing are termed epistemological beliefs, recognizing that beliefs about the nature of knowledge are inextricably related to beliefs about the nature of learning.

Chan and Elliot (2004) established links between epistemological beliefs and teaching and learning conceptions, finding significant pathways linking the three epistemological beliefs factors, fixed/innate ability, authority/expert knowledge and certainty of knowledge, and the traditional teaching and learning conception, and additionally, found a pathway linking the constructivist conception of teaching and learning with the learning effort/process epistemological beliefs factor.

5. Conclusion

The resultant findings of this present study are equally important for both students and faculty members, since the instructors need to realize the probability of the teaching process becoming an effective variable in the students epistemological beliefs, opening doors to new vistas and stimulating novel alternative solutions and ideas from the students, while similarly, instructors may benefit by helping them to explore the teaching and learning conceptions of the students in their classes, thus encouraging positive student attitudes towards their classes.

A comparison of the epistemological beliefs of the instructors and students, as well as an exploration of the students' personal characteristics as opposed to focusing solely on their educational characteristics, might make a positive contribution to a wider, deeper understanding of the topic in further studies.

Further research could also explore the relationship between teachers' personal characteristics such as their work ethic commitment, self-efficacy and motivation, and the contemporary changes in conceptions of learning and teaching. The researcher therefore recommends a mixed-method approach, combining qualitative and quantitative study designs.

6. Limitation

Notwithstanding these promising findings, there are a couple of noteworthy limitations. Firstly, the study sample for the present study was drawn solely from an undergraduate student teachers population. Valuable future research into the psychometric qualities of the teaching and learning and epistemological beliefs scales could well encompass other populations such as secondary school students, for example. The second limitation of the current study is seen as its only being able to infer correlation, but not causal relationship. Finally, this study conducted in the Hashemite University because a researcher as work in it.

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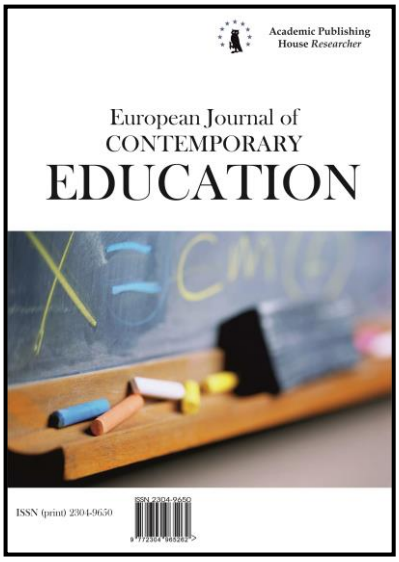
Published in the Slovak Republic
European Journal of Contemporary Education
E-ISSN 2305-6746
2018, 7(3): 541-553
DOI: 10.13187/ejced.2018.3.541
www.ejournal1.com



Civil Values Awareness Formation in High School Students within the Educational Process

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Abstract

The paper covers some conceptual ideas, experience and certain results of forming civil awareness in high-school students of senior grades during the education process. Novelty of the presented paper lies in a comprehensive approach to the issue of the civil awareness formation in high-school senior graders. In this respect the article focuses on the idea of integrating the notion of civil values into the educational process. Such values are called upon to bridge the gap between education and upbringing. The article brings forward the essence and structure of civil values awareness in senior-graders. The paper demonstrates the formation model of the afore-mentioned civil values awareness in students of senior grades. The authors have defined the set of pedagogical conditions required to effectively form civil values awareness in senior-graders, and have developed the evaluation criteria of the extent to which the civil values awareness is developed. Based on the criteria a diagnostic method has been created to evaluate the level of the formed civil values awareness. In the course of research conventional theoretical methods as well empirical methods were used, the preferred one of which was a pedagogical experiment. The authors pointed out the educational process itself is the driving force behind the effective formation of the civil values awareness in the senior-graders, and the process is based on the system of universal human values, national values, and democratic values, which in their turn make the civil values awareness category meaningful. Moreover, the study proved the idea that civil values awareness among the senior-graders is formed in an integrated way both in educational and upbringing activities as well as in extracurricular activity.

Keywords: values awareness, students of senior grades, pedagogical model, pedagogical conditions, educational activities

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1. Introduction

A proven foundation of objectives and values orientation in education is the key element to the success of reorganization and reforms in the field of education. The issue of inclusion of civil values into the educational doctrine for the contemporary high school became quite a pressing one in Russia's condition of emerging civil society. In this regard, the future citizen requires the ability to follow democratic principles and solve problems, coming to a just and socially acceptable solution. Thus, the objective of civil education at the present stage becomes helping senior-grade students obtain experience of democratic conduct, creation of conditions for self-determination. The necessary prerequisite for the senior-graders' self-determination is the formation of civil values awareness. This awareness should be based on mutual spiritual creativity among adults and children directed at comprehension of the civil society's democratic ideals.

Currently we can observe two main trends in the study of values awareness. On the one hand, there have been attempts at creating generalized theories of structure and functioning of a person's behavioral value regulators. In the framework of this study various characteristics of values awareness are developed: (by A.G. Zdravomyslov, M.S. Kagan (Kagan, 1997), V.A. Yadov); the formation mechanism (works by L.M. Arkhangelsky, V.V. Vodzinskaya); hierarchy (S.S. Bubnova, I. G. Dubov). Regulatory role of values awareness in a person's life is researched by M.I. Bobneva, I. Yu. Istoshin.

On the other hand, the study of values awareness is taking on the applied nature, which fact is reflected in papers dedicated to the issues of youth and education. Both the structure and dynamics of value orientation among various youth groups, differentiated by their social, regional, and age characteristics, have been studied (by K.G. Gurova (Gurova, 2000), V.T. Lisovsky (Lisovsky, 2000) et al.); methods of forming values awareness in students under varying conditions and as a part of different academic disciplines (I.V. Redina (Redina, 1999), U.F. Yashchenko (Yashchenko, 1996) et al.). It is possible to set aside a separate group of studies dedicated to the formation of a certain set of values among the youth: spiritual values (by T.I. Petrakova); labour values (by P. R. Ignatenko); professional values (A.Ya. Boev) at al.

Value orientations are the object of numerous studies by foreign scientists (P. White (White, 1996), K. Lucier, A. Maslow (Maslow, 1999), K. Mosher, G. Allport (Allport, 1998), M. Rokeach, V. Frankl, et al.).

To understand the specifics of the civil values awareness formation process in high school students, it was important for us to comprehend modern concepts of civic education and upbringing (L.I. Amanbaeva, T.V. Bolotina (Bolotina, 2002), O.V. Lebedeva (Lebedeva, 2004), A.S. Gayazov, M.A. Shkrobova (Shkrobova, 2001), I.D. Frumin).

At present, Russian pedagogy has developed methodological grounds for the study of the civil values awareness formation in high school students. However, this problem in its entirety as a consistent phenomenon in its historical, social, psychological and technological aspects has not been viewed as the subject of a special study yet. The aspect that is important in the theoretical and practical sense, which reveals the role of the educational process as a specifically organized, purposeful interaction of educators and pupils in the formation of civil values awareness in senior-graders, remains insufficiently researched.

Thus, the following objectives of our study have been set: 1) to develop a pedagogical model for the formation of civil values awareness in high school students in the educational process and to determine the criteria and levels of the formation of civil values awareness of high school students; 2) identify and substantiate a set of pedagogical conditions for the effective formation of civil values awareness in high school students in the educational process.

2. Materials and Methods

The theoretical and methodological basis of our research is: at the general philosophical level - the doctrine of the individual as the subject of the value assimilation of reality (A.G. Zdravomyslov, V.P. Tugarinov), the cultural and historical theory of value development (G.P. Vyzhletsov, M.G. Kagan); at the general scientific level - the theory of the education axiology (N.A. Astashova (Astashova, 2001), V.A. Karakovsky, N.D. Nikandrov); at the scientific and pedagogical level - personal and activity approaches (K.A. Abulkhanova-Slavskaya (Abulkhanova-Slavskaya, 1991), B.G. Ananyev, A.N. Leontiev, S.L. Rubinstein), the essence and laws of an

individual's value orientations, the psychological and pedagogical mechanisms of their formation (L.M. Arkhangelsky, A.V. Kiryakova (Kiryakova, 1996), L.I. Bozhovich,); ideas of a person-centered approach (E.V. Bondarevskaya, I. S. Yakimanskaya), works on the issue of civil and legal education (A.F. Nikitin, V.A. Sukhomlinsky, G.N. Filonov, N.I. Eliasberg); technology of education of integrative personal properties in a democratic school (O.S. Gazman, A.N. Tubelsky), the methodology of pedagogical research (Yu. K. Babansky, B. S. Gershunsky (Gershunsky, 2003), V.I. Zagvyazinsky).

The research methods have been quite comprehensive in their nature and included the following: theoretical ones: the analysis of publications on the research matter; analysis and systematization of the existing experience on civil awareness development accumulated in the domestic and international pedagogy; empirical ones: a pedagogical experiment, observation from within, polling, interviewing, expert evaluation, testing, analysis of senior-graders' creativity; methods of mathematical and statistical analysis of experiment-obtained data. The reliability of the results was confirmed by calculations based on the Wilcoxon and Wilcoxon-Mann-Whitney criteria.

The study was done in several stages within the period from 2000 to 2005 years. The senior grades students of Kirov secondary schools (№ 34, 36) took part in the experiment. In addition, the experimental base included the State Center for Children and Youth Tourism and Excursions; the scientific and research association "TRIZ" at the Museum of the public education history in Kirov. The study involved 2 groups of students, 285 pupils in the experimental group and 97 pupils in the control group, the total number of 382 students.

Stage one – the research and theoretical one (2000-2001) – was dedicated to the theoretical analysis of the studied problem. Stage two – the experimental one (2002-2004) – was focused on developing the program of the formative experiment. As per the study's objective we developed and tested “Kirov: Past, Present, and Future” teaching aid in the experimental group. As a part of extra-curricular educational activities the teaching unit “The Future Of Russia Is In The Hands Of Her Citizens” was developed and tested. The formative experiment was accompanied by diagnostic procedures that monitored the dynamics of the development of civil values awareness of high school students. Stage three – the theoretical and analytical one (2004-2005), we analyzed the obtained data, made general conclusions, evaluated the hypothesis proven level as well as the extent to which the objectives were reached.

Based on the works of the following researchers as A.V. Kiryakova, D.A. Leontiev, S.L. Rubinstein, V.A. Yadov, we have defined the values awareness category as a sustainable attitude to the value of material and spiritual goods, values and ideals making a person strive to reach them and guiding him/her in his/her behavior and actions.

The content of education is determined by the content of the value orientations adopted in the pedagogical system. Content analysis of the value systems proposed by educators made it possible for us to single out those values that define a citizen's relationship to the things sacred to the State and the Nation – State/National values. Also, from the total system of values we isolated values tied to the formation of a person's relationship to values of civil society, and namely, the democratic values. By universal human values we mean moral guidelines that regulate people's lives. This study resulted in the idea that the educational process itself is the driving force behind the effective formation of the civil values awareness in the high school students, when the process is based on the system of universal human values, national/state values, and democratic values, which in their turn make the civil values awareness category meaningful. The civil value guidelines are such concepts as love for the Motherland, national culture, social justice, humane treatment of man, human rights, etc. The theoretical analysis of the researched matter has led to the validation of the definition of the civil values awareness category as a person's value attitude to the democratic ideals of the civil society, expressed in their awareness, felt as a need, acceptance on a positive emotional level, development in various types of socially important activity.

Based on the theory of a personality as a subject of reality values comprehension, the education axiology theory, individual's activity approach,and the technology of a person's integrated properties development in democratic school we have developed a pedagogic model to help form civil values awareness in senior-grade students. The model has the following structural units (Figure 1):

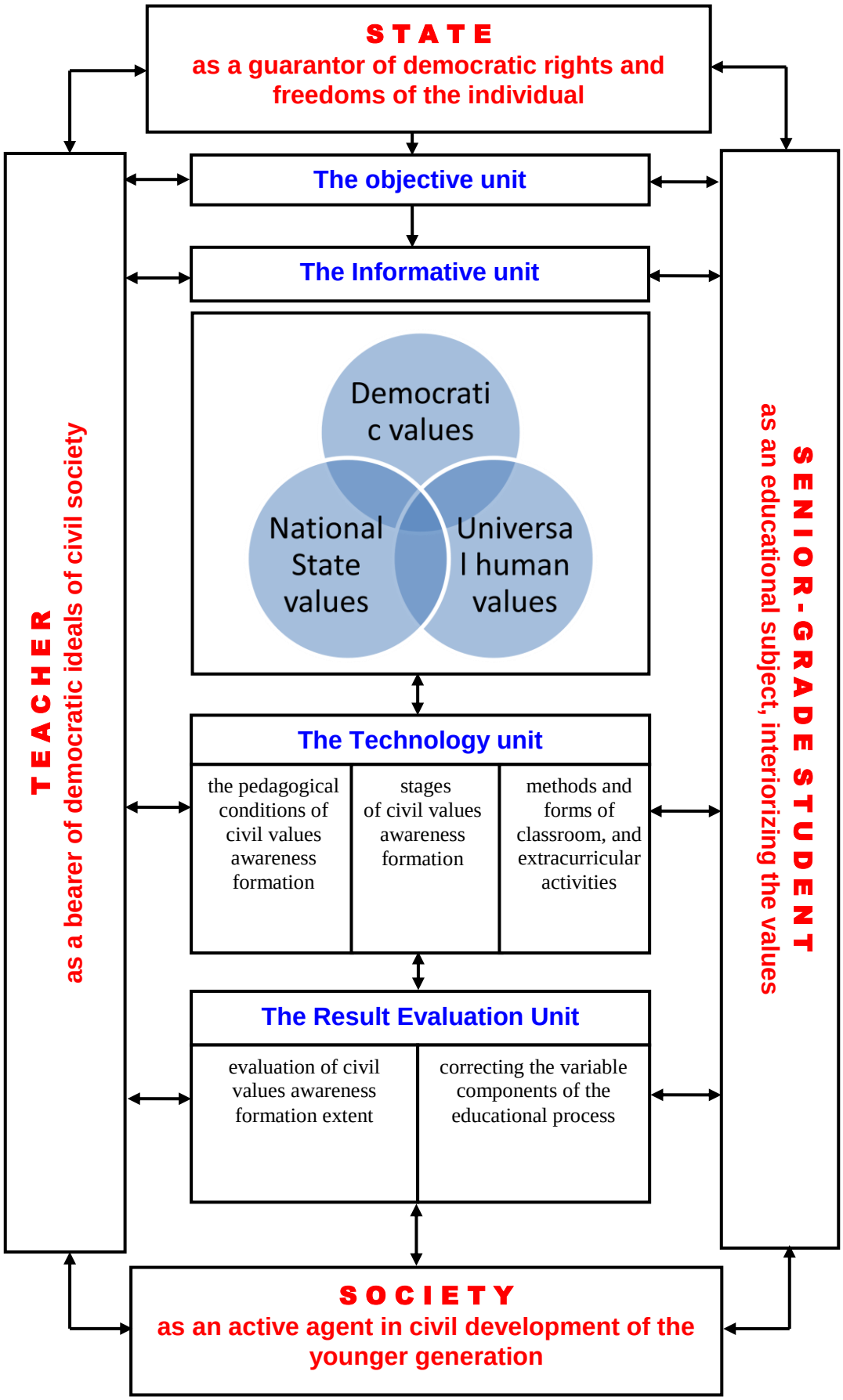

Fig. 1. The model of civil values awareness formation in high school students

1) the Objective unit: on the basis of the society's social demand and the achievements of the pedagogical science, strategic objectives of the educational process are developed, while the aforesaid process is aimed at forming a citizen's personality as of a bearer of democratic ideals of civil society. In accordance with the set objectives, democratic principles of the educational management are defined (a person's self-esteem, humanism, harmonization, dynamism, emotional openness, hierarchy);

2) the Informative unit: democratic ideals of civil society constitute a system of value guidelines, including universal human, national, public and democratic values. An individual's civil values awareness is a complex integrative unity, whose core is made up of the following structural components: the cognitive component, implying the awareness of socially important values and their transformation into a certain inner plan; the motivational component, which is responsible for experiencing the democratic ideals of civil society as necessities; the emotional component, which presupposes positive and willing acceptance of the democratic ideals of civil society; the activities component, which we understand as the absorption process of the democratic ideals of civil society through various civilly important activities;

3) the Technology unit is built with keeping in mind the objectives, concepts, content and structure of civil values awareness and includes pedagogical conditions of efficient civil values awareness formation in students of senior grades, organizational stages of educational activities focused on students' embracing the democratic ideals of the civil society (values presentation to a student, recognition of civil values by an individual, an individual's acceptance of civil values guidelines; realization of civil values awareness through actions and behavior), along with the corresponding pedagogical techniques (projection, imitation, critical thinking, dialogue);

4) the Result evaluation unit: based on the results of the diagnosis of the degree of civil value awareness formation in a senior grade student, certain corrections and adjustments to the educational process are made to further the improvement of the educational process.

The civil values awareness formation process is meant to result in senior-graders' civil competence, which in its turn embraces: the civil knowledge and skills, necessary for the students to socialize in the society, and to do it successfully; students' active citizen view of the position in the society through their active motivated participation in socially-meaningful political school life, their partaking in the community life, country life, and their well-established perception of the Motherland as the subjective and objective Value.

The model of the civil values awareness formation in an individual senior-grade student is based on the idea that students can master the universal human, democratic and National/State values within the educational process under the following conditions:

1) setting the civil element out within the contents of the curriculum components and incorporating their axiological potential both implying reference to values-related aspects of civic education, which are important for the teacher and his/her students;

2) development of self-governance in high school students, which self-governance presupposes such organization of in-school life, as to create preconditions for students' independent creative activity, boosting self-development of a student's personality;

3) involvement of students in specially organized by the teacher values-oriented activities, makes it possible for the teacher to promote students' civil self-determination by letting the students to live through situations, that require making a civil choice. Such activities expand and enrich students' civil and moral experiences;

4) use of civil values awareness formation model as the basis. Based on the pedagogical model, an algorithm of civil values awareness formation in senior-graders is formed. The algorithm includes the following components: analytical, diagnostic, and preparatory. The algorithm encompasses the initial stage of civil values awareness formation functioning as well as the stage of civil values awareness formation development in personalities of senior high school students. The algorithm is characterized by the specifics of the educational institution and depends on the values awareness of students, teachers and values guidelines of the social media, under the influence of which the educational institution exists.

The civil values awareness is formed in both the didactic and educational process, including in-class and extracurricular educational activities (Civil education...), therefore the forming experiment assumed such an organization of the educational process, in which the educational, extracurricular and out-of-school activities act united (Table 1).

Table 1. The content of the educational process directed at the civil values awareness formation in students of senior grades

<table>
<tr><th colspan="3">Educational activity</th><th>Extracurricular activity</th><th>Out-of-school activity</th></tr>
<tr><td>History</td><td>Foreign language</td><td>Social studies</td><td rowspan="4">Unit

“The Future Of Russia Is In The Hands Of Her Citizens” designed as a part of advisory hours system</td><td rowspan="4">Extra classes in the Kirov full-time/correspondence school of local history of the TRIZ Association</td></tr>
<tr><td>Unit “History of the Vyatka Land”</td><td>Unit “The City I Love”, international Internet-projects DEEP, GDD</td><td>Unit “The Economy of the Kirov region”</td></tr>
<tr><td colspan="3">inter-subject links</td></tr>
<tr><td colspan="2">Project “Old Vyatka”</td><td>Project “Tourism Industry Development In The Kirov Region”</td></tr>
</table>

The experiment was performed in several stages: stage I – ascertaining experiment, stage II – formative experiment, stage III – evaluating experiment.

At the ascertaining stage, on the basis of the analysis of the values awareness evaluation techniques developed by Russian and international researchers (M. Rokeach, A.P. Vardomatsky, M.A. Kotik, B.A. Leontiev), it was demonstrated that the only way to evaluate the level to which the hierarchy of the values guidelines system had been formed, and to evaluate the values' content was to use the above-mentioned techniques comprehensively. We took this conclusion into account when we formulated the evaluation technique to determine the level of civil values awareness formation in senior students and, as such to evaluate the real attitude of senior students to democratic ideals. We view the structural components of the civil values awareness as the criteria by which we can evaluate the degree to which an individual's civil values awareness is formed. For every criterion we have set out three development levels, and namely: reproductive, initiative, and creative ones (see Table 2).

Table 2. Characteristics of the civil values awareness formation degree in senior students

Criterion	Degree		
	Reproductive (low)	**Initiative (medium)**	**Creative (high)**
Cognitive	1) no knowledge of basic legal norms; 2) no skills in realization of individual and social rights and obligations; 3) sporadic acts of independence in the search for information	1) knowledge of some basic legal norms; 2) certain skills in realization of individual and social rights and obligations; 3) skills in obtaining information from all available sources	1) knowledge of basic legal norms, understanding of the need for law-abiding acting; 2) ability to practically use human rights defense mechanisms; 3) ability to analyze and critically evaluate information
Motivational	1) sporadic interest to the Homeland's history and culture, knowledge of some historic facts; 2) no need for taking part in social and political activities; 3) no desire for Army service in male senior graders	1) sustained interest to the Homeland's history and culture as well as those of home region, active partaking in the studying of home region's history under the guidance of a teacher; 2) partaking in social and political activities of the school and the community under the guidance of a	1) explicit interest to the Homeland's and home region's history and culture, critical attitude to current social events, awareness of belonging to Homeland's culture; 2) conscious partaking in the social and political activities of the school and the community; 3) readiness to defend the

		teacher; 3) male senior graders realize their Army-service duty	Homeland and for military service by male students
Emotional	1) aim at achieving personal goals; 2) no socially-meaningful value guidelines; 3) situation-derived emotional experience when facing some social issues/problems	1) balanced job- and family-oriented attitude; 2) ability to define one's attitude to socially important values; 3) understanding of social issues and trends taking place in the society	1) conscious aim at individual and creative values; 2) ability to independently evaluate the degree to which the democratic ideals have taken root in the society; 3) ability to consciously plan one's acts in inordinary social situations
Activity-oriented	1) no feeling of responsibility for one's acts; 2) explicit initiative and self-reliance exclusively in familiar activities; 3) lack of conflict-free team-work experience, unsubstantiated evaluation of one's own professional skills	1) ability to analyze one's own acts; 2) evident self-reliance in the process of social and political activity, while self-organization is not so highly developed; 3) ability for team work, ability to justly judge one's professional skills	1) awareness of the role as a citizen and a voter; 2) independence, self-reliance and high self-organization in social and political activities; 3) possession of efficient team-work skills, creativity, set life priorities

The analysis of the results, obtained after the first stage, demonstrated a number of trends, existing in both the experimental and control groups: the values issue is of importance to senior graders. They are interested in both the values issues and their practical implementation, which is of extreme importance for students' self-determination as citizens. At the same time, the students' values preferences demonstrated their bias towards individualism, while their civil values guidelines remained unformed. 55 % of the students demonstrated a lack of desire to take part in social and political activities. 77 % of the students were doubtful of their participation in solving social problems being able to improve their lives. Tests demonstrated that senior students have inadequate information of political events taking place in the country. The results of the ascertaining experiment have proven the importance of the study that we undertook. It has also been demonstrated that there is a need for some special work to test the model for the civil values awareness formation in the educational process in senior grade students.

The educational activity was formed with the emphasis on the civil content of academic disciplines and the use of their axiological potential (study of history and culture of the native town/city, reflexive analysis of its social and economic development). We have created an educational medium, capable of inducing emotional feelings in the students, of introducing them to the world of universal human, National/State and democratic values. Additionally, we have attempted to solve the following tasks: development of senior students' critical thinking based on their handling various information sources; introduction of students to historic roots, grooming their respect for their historic past. In our educational activities we have widely used the project technique and the technique of critical thinking.

In organization of extracurricular activities we have created conditions for the development of the students' independent creative activities. The civil values awareness formation in the students has been based on our “The Future Of Russia Is In The Hands Of Her Citizens” teaching unit, including the following blocks: civil law, local history, military and patriotic, science, economic, and political ones. The Unit Objectives to be reached are the following: love for the Motherland, readiness to defend Her, respect for the State Symbols, tolerance, patriotism and civism, experience of socially beneficial activities. We used the following forms of activities: lectures at the Museum of public education history of the city of Kirov, educational excursions

(visits to the editorial office of a local newspaper, to the Employment center, and the Kirov statistics office), talks with interesting people. The lectures were drawn and delivered by the students themselves under the guidance and supervision of the Museum employees. We used both the imitative (the Star rain, the Lawyer Unto Myself role games) and dialog (talks, disputes, press-conferences, etc.) techniques (Vakhrusheva, 2005).

The extra-curricular activity: the supplementary classes at the TRIZ association significantly raised the students' level of civil competency. The objective of the supplementary classes is to train a senior grade student to practically use human rights defense mechanisms, to facilitate students' creativity and civil self-determination.

The formative experiment demonstrated substantial changes in the senior students' system of values during the formation of their civil values awareness. Among the students of the experimental group we registered an increased interest in the history of their country, more motivated desire to abide by the law, and a more pronounced wish for honest labor. Our technology has boosted the students' creative potential. Those facts were confirmed by the quality of the reports on the students' own creative research, delivered by themselves at scientific conferences of school and city levels.

The pedagogical conditions of effective civil values awareness formation in senior pupils are as follows: 1) taking into consideration the axiological component in all the elements of the curriculum; 2) development of senior students' independent activities; 3) use of civil values awareness formation model as the basis in the senior students' education; 4) involvement of students in specially organized by the teacher values-oriented activities.

Students of the experimental group took part in the Global Democracy Dialogues international program as a part of the formative experiment. The program was designed by the education research programs foundation supported by the US Department of Education. The Program Objectives were to deepen the student's knowledge of the democratic organization of the participant countries; improve Russian students' command of the English language; cultivate democratic thinking in students. Partners of the Russian students were students of La Crescenta High School, CA, USA and Lithuanian students from Raseiniai. The Program agenda presupposed senior students discussing various democratic issues. Every week the participants were offered several questions united by a certain issue. The questions were discussed in the classroom, then the collective answers were e-mailed to other participants in the project. Within five weeks of the project the students discussed such issues as the rights of the individual, freedom of speech and freedom of religion, tolerance towards people of other nationalities, responsibilities and duties of the citizen. Upon completion of the project, students had a chance to participate in a video conference and talk to their peers online.

During the formative experiment we used the social project technique, which we view as an effective educational tool for the formation of the students' necessary social skills and value guidelines.

Students of the experimental group took part in realization of two social projects: Old Vyatka (foreign languages – history), and Tourism Industry Development In The Kirov Region (foreign languages – social studies – economics). The objective of the Old Vyatka social project was to create students' sustainable interest in the history of the home city and the fates of famous fellow-citizens. The project required the senior students to compile information on the still-existing old buildings, and the fates of people, who owned them. The of objective of the What Do Kirovites Think Of The Future Of Russia was to get to know the attitude of Kirovites to the fate of their Motherland and define their civil position in the matter. The students' answers clearly demonstrate that participation in the society's political life becomes a need for the children. Thus, the social activity, presupposed by the project, facilitated understanding of civil and democratic values by the senior students.

3. Results

The evaluation of the senior students' civil values awareness formation results can be done by assessment of the percentage of students at any given stage (reproductive, initiative, and creative), as well as by the Mean Value (MV), enabling us to evaluate the dynamics of the process.

The Mean Value (MV) of the senior students' civil values awareness formation degree is

calculated by the following formula:

$$MV = \frac{a + 2b + 3c}{100} \quad (1)$$

where a, b, c is the percentage of senior students currently being at the reproductive, initiative, and creative stages of civil values awareness formation (Shakeeva, 1998).

We evaluated the effectiveness of individual pedagogical conditions by the efficiency coefficient (EC) which is calculated by the formula:

$$EC = \frac{MV(e_2)}{MV(e_1)} \quad (2)$$

where MV (e_1) is the Mean Value of the civil values awareness formation in the experimental group at the start of the experiment; MV (e_2) is the Mean Value of the civil values awareness formation in the experimental group at the end of the experiment [ditto]. Table 3 represents the obtained results of the students' civil values awareness formation dynamics at the start and at the end of the experiment; as well as effectiveness of individual pedagogical conditions in the formation process.

Table 3. The obtained results of the students' civil values awareness formation dynamics at the start (SE) and at the end (EE) of the experiment

Degree	**School 36**		**TRIZ**		**School 34 Grade 10 B**		**Full-time/correspondence local history school**		**School 34 Grade 10 A**	
	Traditional educational process (%)		Excluding 1st pedagogical condition (%)		Excluding 2nd pedagogical condition (%)		Excluding 3rd pedagogical condition (%)		Effect of the complete pedagogical conditions complex (%)	
	S_E	E_E	S_E	E_E	S_E	E_E	S_E	E_E	S_E	E_E
Reproductive	55.1	33.4	53.3	29.6	56.2	30.9	51.4	28.4	54.9	5.0
Initiative	40.2	57.5	42.6	42.7	39.4	46.8	42.3	44.2	40.1	37.5
Creative	4.7	9.1	4.1	27.7	4.4	22.3	6.3	27.4	5.0	57.5
MV	1.496	1.757	1.508	1.981	1.482	1.914	1.549	1.990	1.501	2.525
EC	-	-	1.008	1.127	0.991	1.089	1.035	1.133	1.003	1.437

The data in the table explicitly demonstrate that the only way to effectively form senior students' civil values awareness is the integrated use of pedagogical conditions.

In addition, the effectiveness of the proposed approach to the formation of senior students' civil values awareness was assessed using the Wilcoxon and Wilcoxon-Mann-Whitney criteria. The experiment involved 382 people, the experimental group included 285 students, the control group – 97 students.

An assessment of the significance of the changes in the observed features in the experimental and control groups during the experiment was carried out using the Wilcoxon test at a confidence level of 95 %. Critical values of statistics are calculated using the following formulas:

$$W(\alpha/2) = \frac{n(n+1)}{4} + \varphi(\alpha/2) \cdot \sqrt{\frac{n(n+1)(2n+1)}{24}} \quad (3)$$

$$W(1-\alpha/2)=\frac{n(n+1)}{2}-W(\alpha/2) \quad (4)$$

Here $\varphi(\alpha)$ is the quantile of the normal distribution for the significance level α. In our study $\alpha=0{,}05$ with a confidence level of 95 %. The value $\varphi(\alpha)$ is found from the statistical tables for the normal distribution and in the case of the bilateral criterion considered $\varphi(\alpha/2)=1{,}96$.

To test the statistical hypothesis of the one-sided Wilcoxon test, the differences compiled for the bilateral criterion $d_i=y_i-x_i$, the number (n) of non-zero differences, the ranks of absolute values $|d_i|$, and the values of the statistics of the criterion T, equal to the sum of the ranks of positive differences d_i and T1, equal to the sum of the ranks of the negative differences d_i.

Critical values of statistics are calculated using the following formulas:

$$W(\alpha)=\frac{n(n+1)}{4}+\varphi(\alpha)\cdot\sqrt{\frac{n(n+1)(2n+1)}{24}} \quad (5)$$

$$W(1-\alpha)=\frac{n(n+1)}{2}-W(\alpha) \quad (6)$$

Here $\varphi(\alpha)$ is the quantile of the normal distribution for $\alpha=0{,}05$ (with a confidence level of 95 %). The value $\varphi(\alpha)$ is found from the statistical tables for the normal distribution and in our case $\varphi(\alpha)=1{,}64$ is equal to the one-sided criterion. The results of calculations are presented in Table 4.

Table 4. Comparison of the experimental and control groups during the experiment

	The calculated value of the Wilcoxon criterion statistics (experimental group)	**Critical significance of the statistics of the bilateral Wilcoxon criterion**		**Critical value of the statistics of the one-sided Wilcoxon criterion**	
	T	W(a/2)	W(1-a/2)	W(a)	W(1-a)
Experimental group	34751,50	23106,94	17648,06	22661,32	18093,68
Conclusion	T> W(α/2)> W(α)	A statistically significant shift towards improved indicators			
Control group	3662,50	2921,212	1831,788	2832,279	1920,721
Conclusion	W(1- α/2)<T< <W(α/2)	There are no statistically significant changes in the indicators studied			

According to the results of a statistical study of the experimental data the following conclusions can be drawn: in the experimental group statistically significant improvements in the studied parameters are observed, while in the control group there are no significant changes.

Comparison of the experimental and control groups by the test characteristics at the beginning of the experiment and at the end of the experiment was carried out using the Wilcoxon-Mann-Whitney criterion. Critical values of statistics are calculated using the following formulas:

$$W(\alpha/2)=\frac{n_1n_2}{2}+\varphi(\alpha/2)\cdot\sqrt{\frac{n_1n_2(n_1+n_2+1)}{12}} \quad (7)$$

$$W(1-\alpha/2)=n_1n_2-W(\alpha/2) \quad (8)$$

Here the value $\varphi(\alpha/2)$ is found from the statistical tables for $\alpha=0{,}05$ (with a confidence level of 95 %). In our case for a two-sided criterion $\varphi(\alpha/2)=1{,}96$.

Critical values of statistics are calculated using the following formulas for one-sided criteria where $\varphi(\alpha) = 1{,}64$. The results of calculations are presented in Table 5.

$$W(\alpha) = \frac{n_1 n_2}{2} + \varphi(\alpha) \cdot \sqrt{\frac{n_1 n_2 (n_1 + n_2 + 1)}{12}} \quad (9)$$

$$W(1-\alpha) = n_1 n_2 - W(\alpha) \quad (10)$$

Table 5. Comparison of the experimental and control groups at the beginning of the experiment and at the end of the experiment

	The calculated value of the Wilcoxon-Mann-Whitney criterion statistics	**Critical significance of the statistics of the bilateral Wilcoxon-Mann-Whitney criterion**		**Critical value of the statistics of the one-sided Wilcoxon-Mann-Whitney criterion**	
	T	W(a/2)	W(1-a/2)	W(a)	W(1-a)
Experimental group	13581,50	15663,58	11981,42	15363	12282
Conclusion	W(1- α/2)<T< <W(α/2)	Groups are statistically indistinguishable by the features under study			
Control group	19649,00	15663,58	11981,42	15363	12282
Conclusion	T> W(α)	The experimental group is much better than the control group			

It should be noted that at the entrance of the experiment the experimental and control groups for the parameters studied were not statistically different, while at the end of the experiment the differences between the groups became significant: the parameters of the experimental group were significantly better than those of the control group.

The senior students of the experimental group are undeniably superior to those of the control group in all the criteria. This fact favorably characterizes the conceptual model of civil values awareness formation in senior students, and it is this very model which is the basis for the formation algorithm.

4. Discussion

The matter of civil values awareness formation in the younger generation has always been and remains of vital importance for the Russian society. It should be noted that the study of this matter has found it reflection in published works by T.Kh. Deberdeeva (2005), L. Farafonova (2006), N.V. Nalyvaiko (2008), A.K. Bykov (2011), L.V. Ardasheva (2012) (Ardasheva, 2012), and I.F. Yarullin (2015) (Yarullin, 2011). These authors consider the civil values awareness formation in high-school and university students of utmost importance in the students' education and training.

At the same time, recent studies treat the issue of introducing the younger generation to civil values as, basically, the values of the integral educational system. Currently, certain aspects of civil education of high-school and university students remain underdeveloped. Such aspects are those concerning principles, technology, and content of education. In this regard, the problem of civil values awareness formation in the younger generation requires further consideration and correction in the context of the modern pedagogical theory.

5. Conclusion

The results of testing the pedagogical model of civil values awareness formation in the senior students have proved the efficiency of our techniques in forming the senior students' civil values awareness. The techniques we used were the following ones: the project technique, the imitation technique, the dialog technique, and the one of critical thinking. The test outcome has demonstrated that the only way to effectively form a senior student's civil values awareness is the integrated use of pedagogical conditions.

Moreover, the results of the experiment have confirmed that civic education of high school senior students through interactive forms and methods is becoming the basis of the education process in general, and the apparent necessity for school and the society as a whole. Merging the civil awareness formation process in senior students with the practice of civil conduct, we solve the task of combining the theory and practice of legitimate conduct of a senior grade student in the society, accumulating certain social experience and self-determination in the system of values.

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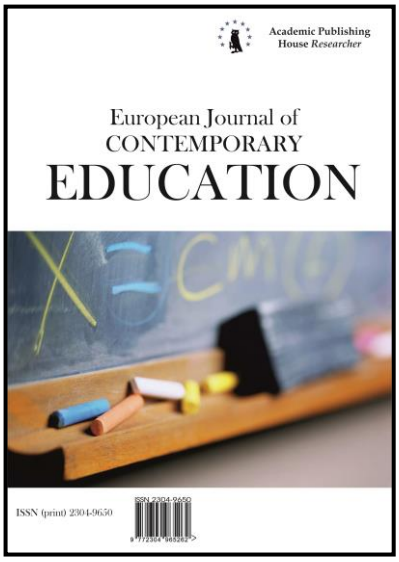
Published in the Slovak Republic
European Journal of Contemporary Education
E-ISSN 2305-6746
2018, 7(3): 554-565
DOI: 10.13187/ejced.2018.3.554
www.ejournal1.com



Investigation of Organizational Silency Levels by Teachers According to Some Demographic Variables

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Abstract

In this research, it was aimed to examine the organizational silence levels of primary and secondary school teachers according to some demographic variables. A total of 609 teachers, 309 women and 300 men, who were teaching at primary and secondary schools participated in the research. The Organizational Silence Scale developed by Van Dyne et al. (2003) and adapted to Turkish by Erdoğan (2011) was used in determining the level of organizational silence that teachers had. SPSS 22.0 data analysis program was used for statistical analysis of the data obtained in the research. Descriptive statistics were used to calculate teachers' demographics and the scores they gained from the scale. MANOVA analysis, which is a parametric analysis method, was used to compare the scale scores according to the demographic characteristics of the teachers. The level of significance in the MANOVA analyzes was determined as $p < 0.05$. At the end of the research, it was determined that the organizational silence levels of the teachers were "moderate". When analyzed according to demographic variables, it was determined that organizational silence levels of teachers did not show statistically significant differences according to school type, education status, settlement type, duty type (teacher/manager status) and branch variables ($p > 0.05$). On the other hand, it was determined that organizational silence levels of the teachers showed statistically significant differences according to gender, marital status, age group and occupational seniority variables ($p < 0.05$). As a result, it was found that the demographic characteristics partially affected the teachers' perceptions of organizational silence, and the findings were in accordance with the literature.

Keywords: Education, teaching profession, organizational silence.

1. Introduction

According to the Turkish Language Association, the silence is "to be silent". To be silent means to be silent and to remain silent. Occupational silence, silence and silence are used

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synonymously in working life. According to psychology science, closing into silence is generally regarded as a negative situation like social silence in sociology, like the sign of unspecifiedness (Çakıcı, 2007: 147). Organizational silence is the situation in which occupants do not react jointly and deliberately to problems or issues encountered in organizations; Or do not share their feelings and thoughts with others "(Ülker, Kanten, 2009: 111). According to another definition, organizational silence is defined as "deliberately suppressing the thoughts, feelings and knowledge of employees in order to improve their jobs and the institution they work with" (Kahveci, Demirtas, 2013: 178).

Although organizational voice is an important force in the change of organizational performance (Bowen, Blackmoon, 2003; Burris and Bartel, 2014: 1013), employees in organizational structure generally prefer to be quiet (Beheshtifar et al., 2012; Milliken et al., 2003: 1453; Premeaux and Bedeian, 2003: 1537; Van Dyne et al., 2003: 339; Panagi et al., 2012: 735; Eriguc et al., 2014: 1359). Organizational silence emerges when employees can not speak freely about the organization (Bowen, Blackmoon, 2003). Organizational silence is a common problem in organizations (Pinder, Harlos, 2001: 331) and there are many factors that cause organizational silence (Kahveci, Demirtas, 2013: 169). In general, the factors that cause organizational silence are divided into various classes such as individual, social (Henriksel, Dayton, 2006: 1539), administrative and organizational factors (Karaca, 2013: 38). Managerial attitudes play an important role in the organizational elements that cause organizational silence. Evaluating the silence as approval, consent or satisfaction increases the silence in organizations (Çakici, 2007: 160). According to Swords and Harbalıoğlu (2014: 330), there are fear and worries among the workers at the beginning of the elements that cause organizational silence. In the research carried out by Çakici (2008: 117), it was determined that organizational silence was mainly caused by administrative and organizational factors, work related fears, lack of experience, fear of isolation and fear of harming relations.

Organizational silence brings some problems in managerial, individual and social aspects (Şimşek, Aktas, 2014: 123), organizational silence has some consequences on both organization and employees (Bagheri et al., 2012: 51). It has been pointed out that organizational silence causes many negative effects especially on employees (Shojaie et al., 2011: 1733). According to the model developed by Morrison and Milliken (2000), at the beginning of the organizational results of silence, the intellectual contributions of employees are not used, avoid negative feedback, filter information and become unresponsive to problems. At the beginning of the results of the silence, it is stated that the individual feels that he/she is feeling weak because he/she is openly talking about his/her problems and worries about his/her workplace, such as lack of loyalty, belongingness, trust, appreciation and support, lack of job satisfaction and intention to leave work. Again according to the developed model, it is emphasized that the silence in the organizations is the lack of feedback, information and alternative opinions and at the same time the employees are preparing the motivation for lack of motivation (Akt: Barçın, 2012: 34).

Despite the fact that silence is common in organizations (Alparslan, Kayalar, 2012: 136; Şimşek and Aktaş, 2014: 123), there is not enough research in the literature on the structure, components and effects of organizational silence (Yapıcı, 2007: 145; Vakola, Bouradas, 2005: 441; Constructor, 2008: 118). For this reason, as organizational silence is investigated, different aspects of organizational silence will be revealed (Kahveci, Demirtas, 2013: 170). As a result of the literature review, it has been seen that the studies on the organizational silence levels of the teachers, especially in the educational institutions, are very limited in the literature. A good knowledge of the factors affecting teachers' organizational silence levels will help to prevent organizational silence formation, as well as to minimize the negative effects of organizational silence in teachers. According to Kahveci and Demirtaş (2013: 168), teachers' silence and the inability to express their problems comfortably prevent them from exhibiting high performance in business life. This situation underlines the fact that the school objectives can not be achieved adequately. Therefore, the factors that affect teachers' perceptions of organizational silence are also important in terms of achieving the aims of the education system. In this study, it was aimed to examine the organizational silence levels of the teachers according to some socio-demographic variables.

2. Materials and methods

Research model

In this study, a scanning model was used from descriptive research models. As is known, screening researches are descriptive studies aimed at determining the characteristics (age, gender, marital status, educational status, etc.) of research subjects of large sample groups.

The Universe and Sampling of the Study

The universe of the research is composed of primary, secondary and high school teachers in the city of Isparta. The sample group of the study consisted of 609 teachers, including 309 women and 300 men, who were working in primary, secondary and high school in Isparta in the academic year of 2016-2017. Findings related to the demographic characteristics of the teachers of the study sample group are presented in Table 1.

Table 1. Frequency and Percentage Distributions of Participants Demographic Information

Variables	Sub-variables	f	%
Gender	Woman	309	50.7
	Man	300	49.3
Maritial status	Married	538	88.3
	Single	71	11.7
School type of the task	Pre-school	12	2.0
	Primary school	223	36.6
	Middle-school	197	32.3
	High school	177	29.1
Task type	Manager	20	3.3
	Assistant director	36	5.9
	Teacher	553	90.8
Education status	Associate	51	8.4
	Lisence	513	84.2
	Graduate	45	7.4
Professional seniority	1-5 yıl	69	11.3
	6-10 yıl	124	20.4
	11-15 yıl	99	16.3
	16-20 yıl	89	14.6
	21-25 yıl	98	16.1
	26-30 yıl	88	14.4
	30+ yıl	42	6.9
Age groups	18-25 yaş	14	2.3
	26-30 yaş	101	16.6
	31-40 yaş	251	41.2
	41-50 yaş	171	28.1
	50+ yaş	72	11.8
Living settlement type	Town centre	430	70.6
	District centre	123	20.2
	Town-village	56	9.2
Branch	Class teacher	188	30.9
	Mid-school Branch	199	32.7
	High scool Branch	165	27.1
	Occupational course	13	2.1
	Guadiance and Psycholohical counseling	13	2.1
	Special education	5	.8
	Pre-school	26	4.3

Data Collection Tool

Survey was used as data collection tool in the research. The first part of the questionnaire used is a personal information form. The personal information form aims to determine the demographic characteristics of the participants. In the second part of the questionnaire used, there is a scale aiming to determine organizational silence levels of the participants. "Organizational Silence Scale" was used in determining the organizational silence levels of the teachers participating in the research. The scale developed by Van Dyne and others (2003) was adapted to Turkish by Erdoğan (2011). The scale consisting of a total of 27 items is of the likert type of 5 and responses to scale items are rated in the range of I definitely do not participate (1) and strongly agree (5) (Tayfun, Çatır, 2013: 121). Besides, there are 6 sub-dimensions related to organizational silence on the scale. The sub-dimensions are the silence for the benefit of the organization, the voice for the benefit of the organization, the silence for defensive purposes, the voice for defense, the accepted silence and the accepted voice. The reliability coefficients of sub scale of organizational silence scale and total scale score in the survey are presented in Table 2.

Table 2. Results of Reliability Analysis on Organizational Silence Scale Factors

Factors	Item numbers	Cronbach's Alpha
Silent for the benefit of the organization	5	.810
Voice for the organizational benefit	4	.881
Defensive silence	6	.862
Defensive voicing	5	.844
Accepted silence	4	.660
Accepted voice	3	.755
Whole schale	27	.824

As shown in Table 2, the reliability coefficient for the entire organizational silence scale, 824, the reliability coefficients for the scale subscales vary from 660 to 881. According to these findings, it is seen that the reliability coefficients of the scale and subscales used in the research are high.

Statistical analysis

SPSS 22.0 program was used in the analysis of the obtained data. MANOVA analysis, which is a parametric analysis method, was used to compare the scale scores according to the demographic information of the participants, since the data related to the Organizational Silence Scale showed normal distribution. The level of significance in the MANOVA analyzes was determined as $p < 0.05$. Descriptive statistics were used to determine frequency and percentage distributions of demographic information of participants and to determine the mean and standard deviations of scale scores.

Limitation of the study

This study limited the group of 609 teachers, who were working in primary, secondary and high school in Isparta in the academic year of 2016-2017.

3. Results

Table 3. Descriptive Statistics of Participants' Organizational Silence Scores

Factors	N	X	Ss
Silent forthe benefit of the organization	609	3.43	.744
Voice for organizational benefit	609	3.99	.816
Defensive silence	609	2.19	.817
Defensive voicing	609	2.11	.881
Accepted silence	609	2.42	.797
Accepted voice	609	3.07	.760

When the Table 3 is examined, it is seen that the participants have a moderate level of silence and organizational benefits for the organization, moderate defense scores, defensive voice and accepted silence scores, and accepted voice scores are moderate.

Table 4. MANOVA Table for Comparison of Participants' Organizational Silence Situations by Sex

Gender		Silent fort he benefit of the organization	Voice for organizational benefit	Defensive silence	Defensive voicing	Accepted silence	Accepted voice
Man	X	3.42	4.03	2.21	2.18	2.43	3.10
	Ss	.813	.824	.894	.960	.856	.767
Women	X	3.44	3.95	2.17	2.04	2.42	3.03
	Ss	.667	.808	.729	.788	.733	.752

As shown in Table 4, there was no statistically significant difference between the organizational silence cases according to the gender of participants (Wilks' Lambda = 0.987; F (6.602) = 1.311; p >0.05)

Table 5. MANOVA Table on Participants' Comparisons of Organizational Silence Situations According to Their Marital Status

Marritial statutes		Silent fort he the benefit of the organizati on	Voice for organizational benefit	Defensive silence	Defensive voicing	Accepted silence	Accepted voice
Married	X	3.43	3.99	2.20	2.10	2.45	3.09
	Ss	.754	.819	.834	.883	.801	.767
Single	X	3.45	3.97	2.09	2.22	2.20	2.90
	Ss	.662	.799	.670	.872	.734	.686

As shown in Table 5, there was no statistically significant difference between the organizational silence cases according to the marital status of participants (Wilks' Lambda = 0.973; F (6.602) = 2.776; p >0.05).

Table 6. MANOVA Table on the Comparison of the Organizational Silence Situations of the Participants According to Their School Activities

School type		Silent fort he the benefit of the organizati on	Voice for organizatio nal benefit	Defensiv e silence	Defensive voicing	Accepted silence	Accepted voice
Pre-school	X	3.40	3.96	1.99	2.10	2.40	2.83
	Ss	.734	.897	.757	.968	.829	.785
Primary school	X	3.37	3.94	2.15	2.10	2.41	3.06
	Ss	.764	.859	.754	.864	.824	.763
Midddle school	X	3.51	4.01	2.20	2.11	2.51	3.07
	Ss	.708	.730	.857	.915	.826	.763
High school	X	3.43	4.03	2.24	2.13	2.35	3.09
	Ss	.755	.849	.852	.866	.722	.755

As shown in Table 6, there was no statistically significant difference between the organizational silence cases according to the school attended by the participants (Wilks' Lambda = 0.976; F (18.1697) = 0.798; p >0.05).

Table 7. MANOVA Table on Comparing Participants According to Their Tasks of Organizational Silence

Task		Silent fort he the benefit of the organization	Voice for organization al benefit	Voice for organizational benefit	Defensive voicing	Accepted silence	Accepted voice
Director	X	3.34	3.91	2.40	2.46	2.59	3.25
	Ss	.844	.971	1.039	1.113	.954	.954
Asistant director	X	3.23	3.85	2.16	2.20	2.12	2.77
	Ss	.647	.899	.745	.927	.970	.816
Teacher	X	3.45	4.00	2.19	2.09	2.44	3.08
	Ss	.745	.805	.813	.868	.776	.745

As shown in Table 7, there was no statistically significant difference between organizational silence cases according to the duties of the participants (Wilks' Lambda = 0.971, F (12.1202) = 1.498, p >0.05).

Table 8. MANOVA Table on Comparing Participants' Situations of Organizational Silence According to Their Educational Status

Educationa l status		Silent fort he the benefit of the organization	Voice for organizational benefit	Defensive silence	Defensive voicing	Accepted silence	Accepted voice
Pre-license	X	3.39	3.88	2.25	2.31	2.55	3.07
	Ss	.851	.927	.778	.998	.733	.671
License	X	3.45	4.00	2.19	2.10	2.43	3.07
	Ss	.721	.813	.822	.870	.800	.772
Graduate	X	3.24	4.06	2.16	2.04	2.22	3.01
	Ss	.848	.723	.806	.867	.819	.726

As shown in Table 8, there was no statistically significant difference in organizational silence cases according to the educational status of the participants (Wilks' Lambda = 0.981; F (12.1202) = 0.957; p >0.05).

Table 9. MANOVA Table on Participants' Comparisons of Organizational Silence Situations According to Occupational Ages

Professional seniority		Silent for thr benefit of the organizatio n	Voice for organization al benefit	Defensive silence	Defensive voicing	Accepted silence	Accepted voice
1-5 yıl	X	3.40	4.01	2.22	2.06	2.29	3.05
	Ss	.587	.702	.678	.649	.794	.657
6-10 yıl	X	3.42	4.03	2.01	1.90	2.40	3.11
	Ss	.803	.777	.682	.766	.734	.664
11-15 yıl	X	3.43	3.93	2.12	2.03	2.33	2.99
	Ss	.613	.770	.786	.799	.768	.825
16-20 yıl	X	3.36	3.98	2.15	2.08	2.42	3.00
	Ss	.771	.892	.790	.832	.749	.762
21-25 yıl	X	3.47	3.84	2.27	2.15	2.43	3.06
	Ss	.671	.981	.921	1.008	.736	.829
26-30 yıl	X	3.38	4.10	2.43	2.39	2.61	3.28
	Ss	.942	.781	.950	1.032	.938	.728
30+ yıl	X	3.70	4.12	2.26	2.43	2.56	2.83
	Ss	.692	.663	.863	.971	.925	.840

As shown in Table 9, the participants 'silence, defensive voice, and accepted silence factor scores differed statistically by occupational seniority, but there was no statistically significant difference in other organizational silence factors according to the occupational seniority of the participants (Wilks' Lambda = 0.890; F (36. 2624) = 1.957; p >0.05).The difference in the defensive silence factor stems from the fact that the scores of the participants with professional seniority 26-30 years were higher than the participants with professional seniority 6-10 years. The difference in defense voice scores is due to the fact that the scores of participants with professional seniority of 26-30 years and occupational seniority of 30+ years were higher than participants with occupational seniority of 6-10 years. The difference in the accepted voice factor is due to the fact that the scores of the participants with professional seniority 26-30 years were higher than the participants with professional seniority 30+ years.

Table 10. MANOVA Table on the Comparison of Participants' Situations of Organizational Silence According to the Number of Children

Number of children		Silent for the benefit of the organization	Voice for organizational benefit	Defensive silence	Defensive voicing	Accepted silence	Accepted voice
No children	X	3.46	4.00	2.06	2.03	2.23	2.99
	Ss	.687	.783	.737	.812	.817	.685
1 kid	X	3.39	4.02	2.19	2.10	2.50	3.15
	Ss	.756	.777	.799	.912	.775	.693
2 kids	X	3.43	3.96	2.22	2.14	2.45	3.06
	Ss	.745	.822	.828	.876	.818	.811
3 kids	X	3.42	4.06	2.21	2.08	2.39	3.03
	Ss	.801	.849	.815	.909	.684	.786
4 kids	X	3.69	3.93	2.48	2.40	2.54	3.00
	Ss	.718	1.152	1.152	.997	.858	.791

As shown in Table 10, there was no statistically significant difference between the organizational silence cases of the participants according to the number of children (Wilks' Lambda = 0.967; F (24.2090) = 0.852; p >0.05).

Table 11. MANOVA Table on the Comparison of Participants' Age Groups with Organizational Silence

Age group		Silent for the benefit of the organization	Voice for organizational benefit	Defensive silence	Defensive voicing	Accepted silence	Accepted voice
18-25 years	X	3.63	4.16	2.31	2.36	2.30	2.69
	Ss	.508	.886	.691	.874	.674	.423
26-30 years	X	3.32	4.00	2.09	2.01	2.32	3.08
	Ss	.737	.568	.692	.719	.733	.698
31-40 years	X	3.41	3.95	2.13	1.99	2.38	3.04
	Ss	.693	.867	.730	.801	.760	.721
41-50 years	X	3.46	4.02	2.32	2.22	2.49	3.12
	Ss	.782	.824	.954	.971	.841	.829
50+years	X	3.53	4.03	2.22	2.35	2.61	3.07
	Ss	.856	.902	.903	1.050	.898	.843

As shown in Table 11, participants' scores for defensive vocalization factor differ statistically by age groups, Wilks' Lambda = 0.935, F (24.2090) = 1.682, p <0.05). However, there was no statistically significant difference in the other organizational silence factors according to the age groups of the participants. The difference in the defensive voice factor is due to the fact that the scores of the participants in the 50+ age group are higher than those of the participants in the 31-40 age group.

Table 12. MANOVA Table on Participants' Comparisons of Organizational Silence Situations According to Their Place of Residence

Settlement		Silent for the benefit of the organization	Voice for organizational benefit	Defensive silence	Defensive voicing	Accepted silence	Accepted voice
City center	X	3.43	4.00	2.21	2.13	2.44	3.05
	Ss	.754	.800	.805	.901	.804	.757
District center	X	3.47	3.98	2.12	2.06	2.40	3.08
	Ss	.724	.895	.900	.880	.801	.807
Town-villagge	X	3.40	3.94	2.22	2.13	2.36	3.12
	Ss	.718	.772	.713	.732	.743	.683

As shown in Table 12, there was no statistically significant difference between the organizational silence cases according to the residents living there (Wilks' Lambda = 0.992; F (12.1202) = 0.392; p >0.05).

Table 13. MANOVA Table on Participants' Comparisons of Organizational Silence Situations According to Branches

Branch							
Class teacher	X	3.40	3.96	2.26	2.25	2.46	3.08
	Ss	.783	.846	.827	.937	.852	.811
Branch (middle-school)	X	3.45	3.99	2.06	1.98	2.43	3.03
	Ss	.707	.773	.754	.830	.786	.724
Branch (high school)	X	3.43	4.02	2.26	2.16	2.36	3.07
	Ss	.760	.844	.873	.893	.730	.749
Vocational courses	X	3.22	3.98	2.21	2.12	2.52	3.18
	Ss	.826	.844	.496	.728	.657	.753
guidance and psychological counseling .	X	3.58	3.88	2.32	1.86	2.25	2.92
	Ss	.420	.583	.699	.713	.842	.564
Special education	X	3.00	4.05	2.03	1.90	2.15	3.00
	Ss	.938	.512	.803	.548	1.055	.667
Pre-school	X	3.63	4.05	2.26	1.92	2.65	3.17
	Ss	.659	.927	.956	.848	.892	.871

4. Discussion and Conclusion

It was found that the teachers who participated in the research were found to have a higher level of silence and organizational benefit than medium level for the benefit of the organization, defensive purpose silence, defense purpose voice and accepted silence scores were below the middle level and accepted voice scores were moderate.Similar research findings on public employees and teachers in the literature reveal that the organizational silence levels of employees are at the middle level (Şimşek, Aktaş, 2014: 128; Sezgin-Nartgül, Kartal, 2013: 55; Çiçek-Sağlam, Yüksel, 2015: 325). In this context, it can be said that the findings obtained in the research are in parallel with the literature.

It was determined that the levels of organizational silence of the teachers participating in the study did not show any significant difference according to the gender variable. It was determined that organizational silence levels of the male and female teachers showed similarity according to the findings obtained. When it is considered according to the gender variable, it is seen that the research findings in the literature show contradictory results.As a matter of fact, it has been found that in some researches, gender variable is an important determinant of organizational silence (Çınar et al., 2013: 319; Çiçek-Sağlam, Yüksel, 2015: 325) and in some studies organizational silence did not show any significant difference according to gender (Kılıçlar ve Harbalıoğlu, 2014: 336; Sezgin-Nartgül ve Kartal, 2013: 47). The reason for the lack of significant differences in the level of organizational silence between the teachers and the sexes is that the preference of both female and male teachers to meet with organizational problems and to be silent in the face of the problems faced by both male and female teachers in parallel can be considered.

It was found that the scores of the teachers who participated in the study showed a significant difference according to the marital status variable and the accepted silence levels of the married teachers were found to be higher when compared to the single teachers according to the findings obtained. It was determined that the scores obtained from the other sub-dimensions related to organizational silence did not show any significant difference according to the marital status of the teachers. In the research conducted by Kılıçlar and Harbalıoğlu (2014: 337), the levels of organizational silence of individuals working in the tourism sector were examined according to the marital status variable and the level of organizational silence of married employees was found to be higher when compared to single employees at the end of the research.Generally speaking, married teachers have a high level of organizational silence compared to single teachers, married teachers have an intense life outside of work life, high family responsibilities outside work life, and therefore they can be thought to be insensitive to organizational problems in a busy life.

It was determined that the levels of organizational silence of the teachers participating in the research did not show any significant difference according to the type of school they were working on. The outcome of this outcome can be thought of as the reasons for the similarity of organizational problems encountered in schools, the similarities between school administrations and teachers, the similarity of management systems, the similar level of organizational commitment of teachers, and the similar organizational climate and cultural heritage.Research findings in the literature also show that organizational climate, organizational commitment, and relationships with managers in educational institutions have a significant effect on organizational silence (Yaman, Ruçlar, 2014: 36; Qazelvand, Shahtalebi, 2016: 105;Karabag-Köse, 2014: 28).

It was determined that the level of organizational silence of the teachers participating in the research showed significant difference according to the age groups and that the teachers who were in the age group of 50 and above according to the findings were found to have higher defense levels than the teachers in the age group of 31-40 years. At the basis of this result, it can be considered that the higher the professional experience of the teachers in the older age group, and accordingly the higher the motivation to defend themselves in the matters that they are right in the organizational structure.

Another reason for the differences in the level of defense voices according to age groups of teachers is the fact that the causes of the teachers' silence in age groups are different from each other. In researches in the literature, it has been found that the subjects who are silent in the organizational structure show significant differences according to age groups (Çakıcı, 2008: 127; Yaman and Ruçlar, 2014: 39).

It was determined that the levels of organizational silence of the teachers who participated in the research did not show any significant difference with respect to the settlement area where they lived (city center, district center, town – village). As it is known, administrative and organizational elements are at the head of the basic elements that cause organizational silence in employees (Çakıcı, 2008: 130). In this context, it can be considered that the level of organizational silence of the teachers participating in the research does not differ according to the place where they are working, and that the schools in the settlements have similar organizational and administrative structures.

It was determined that organizational silence levels of the teachers participating in the research did not show any significant difference according to the branches. As is known, there are managerial, organizational and business related factors at the beginning of the walls that cause organizational silence in educational institutions (Cemaloğlu et al., 2013: 112; Celep, Kaya, 2016: 233). In this context, it can be considered that the organizational silence levels of the teachers are similar to the branch variables, the similarities of the problems faced by the teachers towards their branches in the schools, the similarity of the organizational commitment levels of the branch teachers and the managerial attitudes towards the branch teachers. On the other hand, it can be said that the approach of school administrations within the framework of management understanding similar to all branch teachers contributed to this result.

As a result, it was determined that the levels of organizational silence of the teachers participating in the research did not show any significant difference according to the type of school, the place of employment, educational status and branch variables. It is thought that the fact that the schools they work in have the similar organizational culture and management forms in the emergence of these results. It has been shown that the vast majority of participants have the same educational status as the reason why organizational silence levels are similar according to their level of education. In addition, it was determined that organizational silence levels of teachers were significantly different according to gender, marital status, age and occupational seniority variables, and these results were found to be in parallel with the literature. As is known, the levels of organizational silence of teachers influence both the performance of the work and the productivity of the education system. Therefore, it can be said that the researches on the factors affecting teachers' organizational silence levels should be increased

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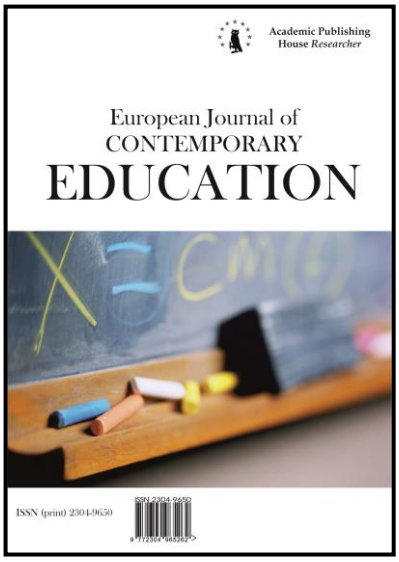
Published in the Slovak Republic
European Journal of Contemporary Education
E-ISSN 2305-6746
2018, 7(3): 566-580
DOI: 10.13187/ejced.2018.3.566
www.ejournal1.com



Approaches to Teaching Geometry in Kazakhstan Schools Using Information Computer Resources for Educational Purposes

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Abstract

In the context of rapid technological changes and modernization of society, the issue of ensuring adequacy of content in secondary education based on the use of advanced information technologies (ICT) is being updated. The necessity of an appropriate level of primary intellectual activity development in a person in terms of the current trends in society has been determined. In this regard, the goal of the article is to argue advantages of using software products in geometry lessons in the secondary education system of the Republic of Kazakhstan (RK). By the method of expert assessments, criteria for effectiveness of using ICT in geometry lessons have been developed to form applied geometric competencies in students. Functional advantages of certain software product types in the process of teaching geometry in secondary education have been substantiated. A set of practical tasks with the use of ICT for the academic discipline of geometry has been developed. Based on a pedagogical experiment, the effectiveness of using such ICTs in geometry lessons as Microsoft PowerPoint, Microsoft Excel and AutoCAD ensuring applied orientation of the academic discipline has been substantiated and proved. The main problems of introducing ICT in the educational process in the current context have been identified. A set of practical measures has been presented that would contribute to effective and extensive ICT absorption in the process of teaching geometry in secondary education. The presented scientific research findings will contribute to implementation of the advanced education concept and its computerization under the conditions of information society development.

Keywords: secondary education system, geometry, geometric competencies, computer information technologies, learning process technology.

1. Introduction

The quality of education is assessed by the level of knowledge gained, by formation of creative personal qualities and practical competencies aimed at performing social and professional

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functions (Herppich et al., 2017). What should rank first in general scholarship of an intellectual is their geometric education and formed geometric competencies (Pervushkina, Efimovich, 2015). This owes to the fact that people live in a substantial world that is structurally geometric. However, in the course of time, new areas of spatial perception are formed (virtual spaces, multidimensional spaces, digital technologies, etc.), production and industrial technologies change as well (Suh, Prophet, 2018). With all these changes, the main provisions of the very discipline "Geometry" are not only preserved without losing their relevance, but are also developing (Mammarella et al., 2017). Pursuant thereto, geometry leaning goals and technologies and, accordingly, geometric education in the secondary education system of the Republic of Kazakhstan based on the use of information and computer technologies should change (Nazarbayev, 2012; Almaty Education Department, 2013).

Any teaching technology is information technology, as the basis of technological learning process is formed by acquisition and transformation of information (Heitink et al., 2016). Formation of new information technologies within subject geometry lessons enhances the need for creation of new courseware aimed at qualitative improvement of lesson effectiveness (Heitink et al., 2016). Therefore, for successful and purposeful use of information technology in the educational process, secondary education teachers should know a general description of operation principles and didactic scope of software applications and then, based on their experience and recommendations, use them in the educational process. Such an approach contributes to formation of practical geometric competencies in students by means of learning process individualization, students' independent work intensification and training differentiation (Rambousek et al., 2015; Gastelú et al., 2015).

In this regard, the goal of the research is to substantiate the effectiveness of introducing ICT in the geometry teaching process using the example of eleven graders in Lyceum No. 9 named after O. Zholdasbekov in Shymkent with advanced study of mathematics and physics. Within the framework of the research, the following tasks of scientific cognition have been solved: the main problems in the geometry teaching process in secondary education of Kazakhstan have been identified; the most effective ICTs for formation of applied geometric competencies in students in the process of teaching geometry have been determined and the advantages of their use in the educational process based on the pedagogical experiment have been argued; a set of practical measures to increase the effectiveness of ICT use in geometry lessons has been substantiated.

2. Materials and methods

The methodological basis of the research is the following scientific cognition methods.

A pedagogical experiment is a set of logically arranged research operations aimed at a purposeful observation of the educational process in the context of regulated changes in certain characteristics of its progress conditions (Massyrova et al., 2015).

The pedagogical experiment implementation in this study involves the following successive steps:

1. Justification of criteria for comparing software products. Proof of the criteria system representativeness (equations 1, 2);
2. Comparative analysis of software products applicable for geometry studies in school, selection of the most effective ones in terms of feasibility of mathematical operations;
3. Determination of the selected programs use indicating didactic goals and objectives that are to be solved by means of these programs and examples of the software use;
4. Formation of a control and experimental group of students to assess the effectiveness of ICT use;
5. Teaching a class according to a Geometry Training Program using ICTs by areas of activity to the experimental group and the same class without using ICTs to the control group;
6. Development of assignments to diagnose the students' level of knowledge following the classes given. Evaluation of an assignment quality: reliability (equation 3) and validity (equation 4);
7. Assessment of the students' knowledge in the control and experimental groups. A test of statistical significance of differences in the students' level of knowledge obtained in the control and experimental groups (equation 5);
8. Calculating the ICT use effectiveness index in geometry lessons (equation 4), proof of ICT feasibility for geometry studies.

The experiment was carried out on eleven graders in Lyceum No. 9 named after O. Zholdasbekov in Shymkent with advanced study of mathematics and physics, with a total of 188 students (96.4 % of all the eleven graders in the school).

Expert assessment method. This statistical method was used to define effectiveness criteria certain software products use in geometry lessons in terms of their feasibility in the educational process in the form of a generalized opinion of professionals (experts).

To substantiate representativeness of the criteria for comparing software products and assessing feasibility of their introduction in the educational process for geometry studies, an expert group was formed. It included: Deputy Director for Studies and Educational work, four math teachers of Lyceum No. 9 in Shymkent, through the example of which the feasibility of ICT introduction in the educational process in geometry studies is assessed, and two computer science teachers.

The competence of the expert group on ICT introduction in teaching geometry is confirmed by higher teacher education of the experts, the teaching of mathematics and computer science, and over 10 years' work experience in the teaching profession.

The method of individual scoring was applied, whereby the experts were asked to assess the representativeness of each criteria separately (the applicability of each criterion in evaluation) and the entire proposed criteria system on a scale from one to ten (how much the proposed system is able to characterize the feasibility of ICT introduction in geometry teaching process). Score 0 indicates the lack of representativeness in a criterion, 10 stands for the maximum representativeness and the possibility to assess ICT feasibility by this criterion.

The representativeness coefficient is calculated by the formula (Astfalck et al., 2018):

$$R = \frac{\sum_{i=1}^{n} a_i}{\sum_{i=1}^{n} \acute{a}_i} \cdot 100\%, \quad (1)$$

where R is the representativeness coefficient of a criterion (criteria system), as %;

a_i is the estimate of representativeness by an expert;

$\acute{a}_i$ is the maximum possible estimate by an expert (10 points);

n is the number of experts.

The use of individual expert assessment makes it possible to level out the influence of other experts, thereby ensuring unbiased opinions.

Consistency of expert opinions is indicated by the value of variation coefficient (<10 %) (equation 1) (Rousseau et al., 2018):

$$v = \frac{\sigma}{\bar{x}} * 100\ \%, \quad (2)$$

where v is the variation coefficient of the expert estimates, as %;

σ is a standard deviation of the experts' estimates;

$\bar{x}$ is the arithmetic mean deviation of the expert estimates.

Interpretation of the results is as follows:

$v \leq 10$ % indicates that the expert estimates are characterized by low variability and a high degree of consistency;

$10 < v \leq 20$ % indicates that the expert estimates are characterized by an average degree of variability;

$v > 20$ % indicates that that expert estimates are characterized by a high variability and the degree of expert consistency is low.

The quality of test assignments (stereotyped level), their feasibility for assessing students' knowledge has been evaluated by reliability (3) and validity (4) indices (Ryabinova, Bulanova, 2016).

$$K_r = \frac{n}{n-1} \cdot \left(1 - \frac{\sum_{i=1}^{n} p_i q_i}{S^2}\right), \quad (3)$$

where n is the number of test assignments;

p_i is the ratio of correct answers to the –th assignment;

q_i is the ratio of incorrect answers to the –th assignment;

S^2 is the variability of the scores obtained.

$$K_v = \frac{(\overline{X_1})_i - (\overline{X_0})_i}{S} \cdot \sqrt{\frac{(N_1)_i \cdot (N_0)_i}{N(N-1)}}, \quad (4)$$

where $(\overline{X_1})_i$ is the average value of individual scores of the students (the average grade in geometry in the past year) who completed the task correctly;

$(\overline{X_0})_i$ is the average value of individual scores of the students(the average grade in geometry in the past year) who did not complete the task correctly;

S is a standard deviation of individual points;

$(N_1)_i$ is the number of students who completed the task correctly;

$(N_0)_i$ is the number of students who did not complete the task correctly;

N is the number of students tested.

The reliability indicator characterizes the invariance of the test under the effect of random variables. The test is feasible at $K_r \geq 0.7$.

Validity is a test applicability index showing the possibility to use it for a specific purpose (in this case, to assess the level of geometry knowledge). The validity index in the range [-1; +1] is measured, where -1 means there is no correlation between students' performance level in geometry and the test results; +1 means all students with a high performance level gave the correct answers to tests, while incorrect answers were given by those with a low level of academic achievement. If the validity coefficient value is < 0.3, the test has low validity and is not applicable for knowledge assessment; if over the range [0.3; 0.6), it has the average validity; if [0.6; 1], it has high validity (Ryabinova, Bulanova, 2016).

To test the statistical significance of differences in the level of knowledge in the control and experimental sample of students, Pearson's chi-square test is used (χ^2-test). χ^2-test is calculated by the formula (Nabiulina, 2015):

$$\chi^2_{\text{расч}} = \frac{N\cdot(|n_{1k}\cdot n_{0e}-n_{0k}\cdot n_{1e}|-\frac{N}{2})^2}{N_k\cdot N_e\cdot(n_{1k}+n_{1e})\cdot(n_{0k}+n_{0e})}, \quad (5)$$

where N is the number of students tested;

N_k is the number of students in the control group;

N_e is the number of students in the experimental group;

n_{1k} is the number of correct answers to tests among the control group students;

n_{1e} is the number of correct answers to tests among the experimental group students;

n_{0k} is number of incorrect answers to tests among the control group students;

n_{0e} is the number of incorrect answers to tests among the experimental group students.

When $\chi^2_{\text{calc}} > \chi^2_{\text{tab}}$, the null hypothesis of no difference between the values of sample characteristics is rejected, whereas at $\chi^2_{\text{calc}} < \chi^2_{\text{tab}}$ it is accepted.

The effectiveness of ICT use in geometry lessons is calculated by the formula (Massyrova et al., 2015):

$$\eta = \frac{AS_e}{AS_k}, \quad (6)$$

where AS_e is the average score of test results for the experimental group;

AS_k is the average score of test results for the control group.

The value of $\eta > 1$ indicates the feasibility of ICT, whereas $\eta \leq 1$ indicates its unfeasibility.

3. Findings

Learning goals should be consistent with public demands, that is, with those problems that society poses for education. Under the current conditions in Russian schools, geometry syllabus is covered from the perspective of two subdisciplines: plane geometry dealing with planar figures and their properties; solid geometry dealing with solid figures and their properties. Application of plane geometry is essential to the development of such disciplines as physics, chemistry, geography, and others based on understanding the connection between solid figures and the three-dimensional world around. However, given the fact that the geometry course contents are too simplistic, they do not adequately reflect the relationship of geometry with the surrounding world. Internal and logical connection between plane and solid geometry is terminologically and practically substantiated for math teaching method (Pervushkina, Efimovich, 2015), yet, a scientifically grounded methodical technology to implement this relationship with due regard to achievement age and cognitive abilities of students, as well as teaching principles (scietificity, comprehensibility, etc.) remains in progress.

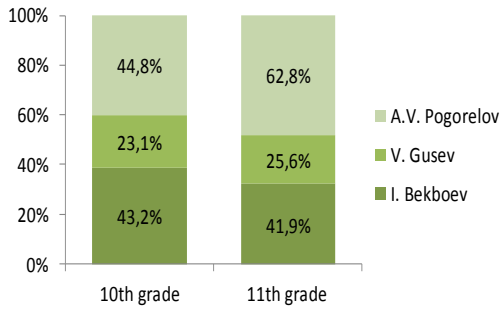
In addition, a destructive factor in the learning process is a distribution of periods when studying geometry areas. Solid geometry studies begin only in the 10thgrade, whereas many students can interrupt their training after the 9thgrade. In other words, students leave school without studying solid geometry.

At the math curricula level in general education school, this problem has found a certain partial solution only as the following changes in the programs:

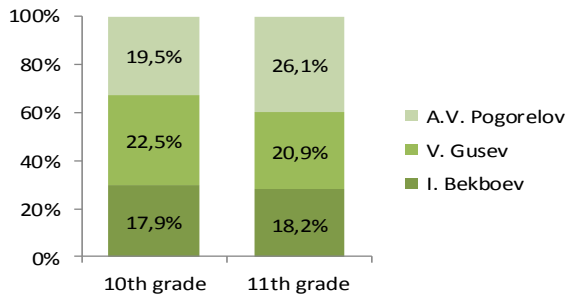
an increased scope of instruction material in geometry studied at the propaedeutic level in the 5th-6thgrades;

the geometry teaching in the middle school is completed with the area "Solid Geometry Elements", whereas only the first solid geometry lessons in the 10th grade provide an insight into polyhedra, solids of revolution and their plane in the sections (Ministry of Education..., 2017).

Another important problem in geometry studies in the secondary education system is applied orientation of the training course inextricably linked with the problem of geometric competency formation in students. Thus, analysis of the most commonly used geometry textbooks in Kazakhstan schools for the 10th-11thgrades has shown that the ratio of learning activities in textbooks for the 10th grade ranges from 23.1 % to 44.8 %, and for the 11th grade it ranges from 25.6 % to 62.8 % (Figure 1), whereas there are 2 % to 7 % of applied problems therein out of the total task material, with the volume of illustrative material not exceeding 22.5 % for the 10th grade and 26.1 % for the 11thgrade (Figure 1). The current situation indicates an insufficient level of applied nature of procedural guidelines for geometry lessons in the secondary education system.



Correlation of tasks



Correlation of visual information

Fig. 1. Correlation of tasks and visual information in geometry textbooks for the 10th-11th grades by the most commonly used authors in the system of secondary education of the Republic of Kazakhstan

Applied orientation of a geometry course is implemented in ways to apply school geometry knowledge in everyday life, in industries and in science. The applied orientation techniques of solid geometry course are focused on formation of students' ability to study the surrounding phenomena in mathematical terms, to analyze, to create mathematical models, that is, they equip students with knowledge and skills that are indispensable in solving problems practically. In this regard, given the shortcomings existing in the process of forming geometric competence in school students, it seems expedient and necessary to mainstream information computer technologies (ICT) in the educational process.

In Kazakhstan, continuous efforts are also taken to digitalize training to fit the times. Within the framework of e-learning, 41 metropolitan educational institutions were included in the experiment, including 32 schools and 9 vocational educational institutions. Project "School of the Future Today" has been implemented in 17 schools of the city. In an interactive studio of the Department of Education, online lessons and educational events were held (Ministry of Education..., 2015). At the same time, in 2015, Astana Innovations JSC launched new pilot project "Smart School", with its performance specifications being almost identical to those of the "School of the Future Today" system (Electronic Office Systems, 2015). Within the government program "Digital Kazakhstan" for 3rd-4th grades, the subject "Information and Communication Technologies", which forms general basic skill to operate modern information technologies for their effective use in learning and everyday life, has been introduced. 372 groups on robotics have

been founded to teach the general basics of programming within the robotics framework. The aim of the project is to organize joint project activities of students and teachers by means of modern and emerging technologies (The Prime Minister..., 2017).

It is planned to set up a specially equipped BilimBook room in schools of three Kazakhstan regions. Bilimbook contains four educational resources in Kazakh, Russian, and English languages – universal educational platform BilimLand, virtual training simulator for UNT (Unified National Testing) and CTA (Complex Testing of Applicants) iTest, full elementary school curriculum in the Kazakh language iMektep, a kit of more than 1,500 absorbing educational films Twig-Bilim. Within the framework of this project, the schools will be equipped with a newly modified room – an interactive whiteboard with a projector and a safe box with 18 touch-screen laptops-transformers. BilimBook is designed for individual use by a student in order to enhance the learning motivation and to stimulate their cognitive activity (Bilim Media Group, 2017).

In addition, specialized package Geometre's Sketchpad, version 3.1, developed by Key Curriculum Press, has been created to study basic geometrical figures and their characteristics (Mukminova, 2016). The program ensures student activity in the field of analysis, problem solving, theorem proving, allows them to reveal trends in geometric phenomena, to formulate theorems for subsequent proving and to develop skills to comprehend them. The package is recommended for use in math lessons in the 6^{th}-9^{th} grades and is widely used in schools of the Republic of Kazakhstan.

ICTs have quite a diverse range of uses in educational process, of which the main ones are: the use of ICT as a computing device and multimedia tools, to simulate various phenomena and processes, as a means for reinforcing the competences developed by students (Olmedo-Torre et al., 2017; Rambousek et al., 2015; Gastelú et al., 2015). Therefore, within the framework of the research, a pedagogical experiment was conducted to determine priority ICTs when studying geometry in schools, as well as the effectiveness of their use.

The pedagogical experiment advantage in this study is the possibility to actively influence the formation of geometric competencies in students by providing new conditions. In this study, new conditions are the use of appropriate ICTs in geometry lessons.

Within the framework of the research, analysis of those main software products has been carried out that are feasible in geometry studies, are of applied nature and contribute to the geometric competence formation.

The results of evaluating the criteria informativeness based on the expert assessment results according to equations 1 and 2 are presented in Table 1.

Table 1. Representativeness indices of the criteria for assessing the feasibility of ICT introduction in the learning process when studying geometry

Criterion	Average representativeness rate, as %	Standard deviation in expert estimates	Variation coefficient of expert estimates, as %
Applicability in plane geometry studies	100	0.0	0.0
Applicability in solid geometry studies	100	0.0	0.0
Option to work with spreadsheets	84	0.5	6.3
Option to work with ready-made geometric figures	93	0.8	8.1
Option to model geometric figures to high precision	96	0.5	5.6
Availability of predefined templates of geometric objects	86	0.5	6.2
Option to design complex real systems	87	0.8	8.7

According to the results of expert evaluation, the most representative criteria are: applicability in plane geometry studies and applicability in solid geometry studies (100 %). The average representativeness rate of all the criteria exceeds 84 %, that is, in 84 % of cases these criteria are applicable for assessing the feasibility of ICT introduction.

The representativeness of the proposed criteria system as a whole is 82 %. The part of unrecorded criteria that can be used to assess the feasibility of ICT introduction is 18 %.

These criteria system allows for an overall assessment of the applicability and feasibility of a certain software product in school geometry studies according to their functional purpose.

The results of comparative analysis of software products based on the expert opinions are presented in Table 2.

Table 2. Comparative analysis of software products for formation of geometric competency in secondary education of the Republic of Kazakhstan

The effectiveness criterion of use in the educational process	Software product							
	Gran-2D	Gran-3D	GeoGebra	Microsoft Excel (Open Office Calc, LibreOffice Calc)	Microsoft PowerPoint	AutoCAD	MatLAB, Mathcad	Statistica
Applicability in plane geometry studies	+	-	+	+	+	+	+	+
Applicability in solid geometry studies	-	+	+	-	+	+	+	+
Option to work with spreadsheets	-	-	-	+	-	-	+	+
Option to work with ready-made geometric figures	+	+	+	+	+	+	+	+
Option to model geometric figures to high precision	+	+	+	+	-	+	+	+
Availability of predefined templates of geometric objects	+	+	+	-	-	+	-	-
Option to design complex real systems	-	-	-	-	-	+	+	+
Share of positive estimates by the criteria,%	**57.1**	**57.1**	**71.4**	**57.1**	**42.9**	**85.7**	**85.7**	**85.7**

The school curriculum in geometry, as already mentioned, consists of two parts: “Plane Geometry” (studied in the 7th-9th grades) and “Solid Geometry” (for the 10th-11th grades), therefore, the main criteria for software products comparison are feasibility of their use when studying these areas of geometry. Out of the programs presented in Table 1, the possibility of studying plane geometry is offered by all the programs with the exception of “Gran-3D”, which is used to model geometric figures in three-dimensional space. In turn, Gran-2D, Microsoft Excel (Open Office Calc, LibreOffice Calc) are inapplicable for studying solid Geometry.

The use of spreadsheets when studying a geometry course allows one to solve the areas and volumes of geometric figures, to find the length of segments, sides, the grade measures of angles, thereby simplifying work with large data arrays. The most common spreadsheet editor aimed at work with spreadsheets is Microsoft Excel (Open Office Calc, LibreOffice Calc) (Grech, 2018). It also allows one to work with Statistica spreadsheets.

Thus, from the comparative analysis (Table 2), all the software products listed above offer the option to work with ready-made geometric figures: their representation in different planes, a stage-by-stage demonstration of their construction process, a visual illustration of differences in properties of geometric figures. In addition, all the programs on this list, except for Microsoft PowerPoint, allow one to model geometric figures. Microsoft PowerPoint is a program for creating and viewing presentations demonstrating ready-made geometric figures and texts that characterize basic properties of these figures and formulas, and their scope of application.

Microsoft PowerPoint allows one to build simple geometric figures, although without high accuracy, because this program provides no opportunity to specify, for example, such data as coordinates of vertices, lengths of sides, angles, etc. (Pate, Posey, 2016).

Gran-2D, Gran-3D, GeoGebra, AutoCAD are specialized programs designed to construct geometric figures, they have ready-made templates.

The possibility to engineer complex real systems is given by software products AutoCAD, MatLAB, Mathcad, and Statistica. They include a wide range of tools for modeling real systems and solving complex technical, economic, environmental, educational, psychological, and other problems by using and reinforcing geometric knowledge and skills.

Based on the results of comparing software products by the proposed criteria, program products AutoCAD, MatLAB, Mathcad, and Statistic are characterized by the highest percentage of positive expert estimates (85.7 %). Yet, given their performance specifications, it can be argued that AutoCAD is the most effective for geometry studies (Liu et al., 2017). This stems from the fact that it provides the most extensive functionality for 3D modeling of geometric objects as compared to MatLAB, Mathcad, Statistica.

Also, it should be noted that it is expedient to use this program in studying both plane geometry and solid geometry, since it allows one to work with figures on two- and three-dimensional planes, to model new figures and to demonstrate those already formed. Applied skills to work in this very program in geometry lessons would lay the groundwork for development of the future competence to model complex real systems used in the higher education system and professional activity.

However, it should be noted that in some cases, additional use of Microsoft Excel to compute and Microsoft PowerPoint to present theoretical material is advisable. It is complementary and integrated use of these software products that will ensure applied nature of the academic discipline "Geometry" and will promote development of geometric competence in secondary school students.

Based on the functionality of Microsoft PowerPoint, Microsoft Excel, and AutoCAD, topic "Cylinder Volume" was developed according to the Geometry Training Program. ICTs were used to develop the following areas of the topic, taking into account attainment of the didactic aim of geometry lessons (Table 3).

Table 3. Scope of ICT use when studying the topic "Cylinder Volume" in geometry lessons for eleven graders of Liceum № 9, Shymkent

Software product	Didactic aim	Issues to be addressed
Microsoft PowerPoint	Theoretical material delivery, visualization of knowledge	The concept and properties of a cylinder. Types of cylinders, their features. Formulas for solving the area of a cylinder base, finding a cylinder volume, height, and cross-sectional area. Applications of cylinders in engineering
Microsoft Excel	Consolidation of the delivered theoretical material, reinforcement of skills in solving geometric problems	Finding a cylinder volume, height, cross-sectional area, base radius
AutoCAD	Consolidation of the delivered theoretical material, modeling geometric objects	Construction of a cylinder with specified characteristics: the base radius, the height. Representation of a geometric figure from different projections. Cross section of a cylinder. Building real object models

Microsoft PowerPoint enables the user to visually demonstrate the model of a cylinder in different planes and draw a parallel with similar reality objects (mechanical parts, buildings) to communicate the practical significance of the topic to students. This would contribute to the

formation of knowledge about the properties of a geometric figure, the ability to determine it in space, the ability to practically apply knowledge and skills. In addition, the use of presentation material enables students to repeatedly return to the material studied on their own, which will improve the perception of the material.

Microsoft Excel is proposed to be used to find a cylinder volume, height, cross-sectional area, base radius. Using spreadsheets allows one to speed up the process of solving similar problems; to sort and filter geometric objects by the following criteria: radius, area, height; to conduct a comparative analysis of objects according to these criteria; to identify the relationship between the height of a cylinder and the cross-sectional area, between the base radius and the cross-sectional area, between the grade measure of an arc that the section plane intercepts and the cross-sectional area. Consequently, the main goal is achieved, which is formation of the ability to solve computational stereometric problems, as well as the skills of operating databases: sorting, filtering, and the use of subtotals. The variety of tasks solved improves perception and acquisition of educational material.

Software product AutoCAD is used for practical consolidation of the delivered theoretical material and modeling of geometric objects (cylinders). This program makes it possible to construct a cylinder by the base radius and the height (Figure 2), to change its parameters by elongating and rotating, to draw a section plane (Figure 3), to create more complex objects consisting of cylinders (Figure 4).

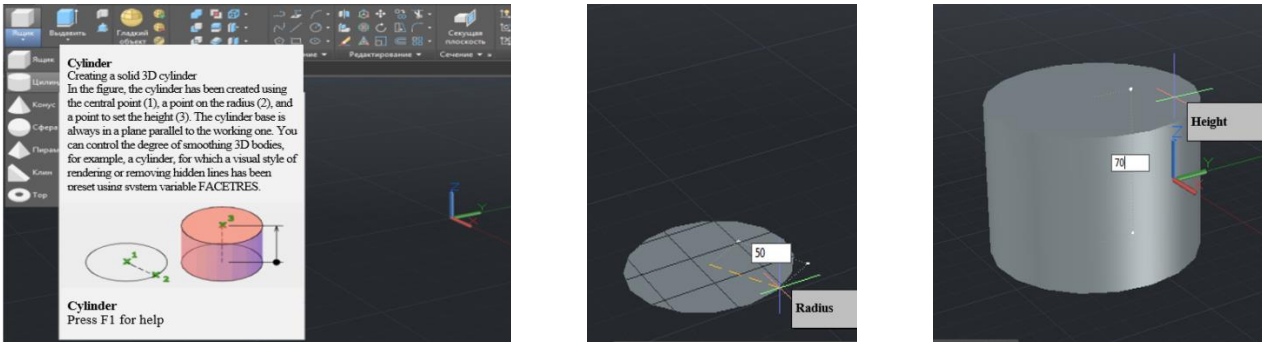


Fig. 2. Constructing a cylinder in AutoCAD

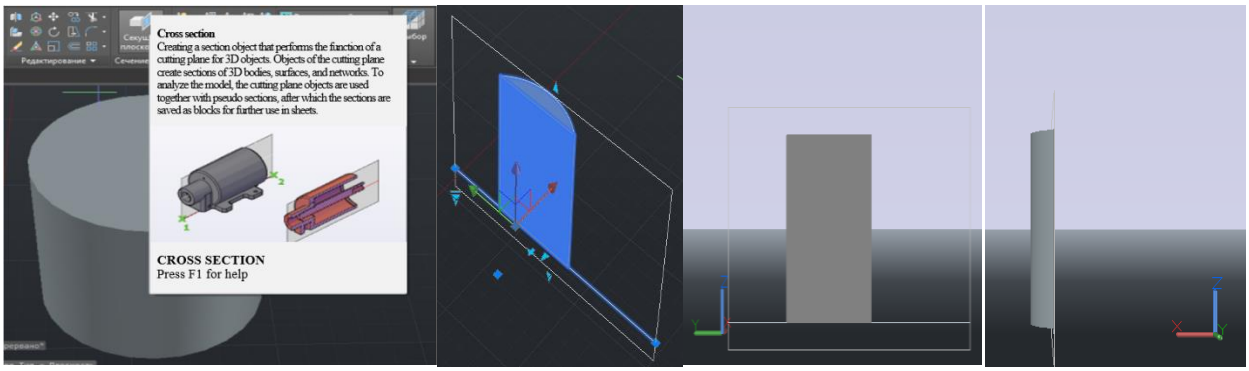


Fig. 3. Cross section of the cylinder from different projections

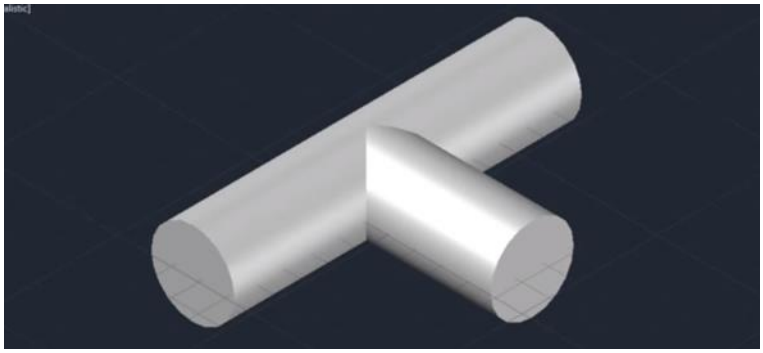
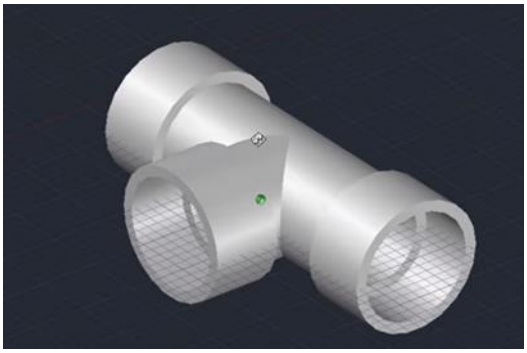



Fig. 4. A water pipeline elbow modeled from cylinders in AutoCAD

The use of ICTs when studying the topic "Cylinder Volume" makes it possible to attain such didactic aims of the lesson as: formation of knowledge about the characteristics and properties of a cylinder; familiarity with the cylinder construction technology in AutoCAD; acquisition of skills to construct a cylinder with specified parameters; formation of abilities to cube a cylinder, to find the base radius and the cross-sectional area.

For the cognitive development purposes, the following tasks are solved: development of spatial awareness in students; development of logical thinking, the ability to generalize and concretize; development of attention and the ability to observe and consolidate knowledge; formation of the ability to compare, to find similarities and differences; development of computer skills, and so on.

To confirm the effectiveness of ICT use in geometry studies, a pedagogical experiment was conducted, whereby eleven graders of Lyceum No. 9 in Shymkent were requested to solve the tasks of two complexity levels: stereotyped tasks by the standard algorithm proposed by the teacher and described in geometry textbooks; heuristic tasks that do not have a standard solution algorithm and require the use of complex geometry knowledge.

The use of tasks of two complexity levels has made it possible to assess the formedness level of baseline competencies (the ability to solve computational stereometric problems), as well as creative, analytical, spatial problems.

Stereotyped problems

Task 1. As a result of a cylinder section, a square is obtained. At what distance from the axis of the cylinder is the section plane drawn? The cylinder height measures 10 cm, the base radius is 6 cm, and the section plane is parallel to the cylinder axis.

Possible answers:

a. 4 cm;
b. $\sqrt{16}$cm;
c. $\sqrt{11}$cm;
d. 9 cm

Task 2. A plane is drawn through a cylinderaxis. Calculate the diagonal of the rectangle resulting from the section if the cylinder base radius measures 7 cm and the height measures 4 cm.

Possible answers:

a. 8 cm;
b. $2\sqrt{53}$cm;
c. 14 cm;
d. $12\sqrt{7}$cm

Task 3. The diameter of a cylinder base (d) is equal to its height (h). $d = h$ = 10 cm. In the cylinder, points in the circumferences of the lower (point K) and upper (point N) bases are connected in such a way that the angle between the radii drawn to these points is $\alpha = 60^{\circ}$. What is the angle between the straight line connecting points K and N and the cylinderaxis?

Possible answers:

a. $arctg\ \frac{1}{2}$;
b. $arccos\frac{3}{8}$;
c. 30°;
d. 45°.

Task 4. A line is drawn through points A and B lying in the circumference of the lower and upper bases of a cylinder, respectively. The angle between the straight line and the cylinder diameter is 45°. What is the total surface area of the cylinder if its height measures 5 cm?

Possible answers:

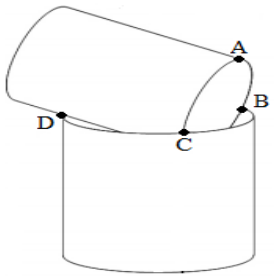
a. 28.3 cm²
b. $31\sqrt{2}$cm²;
c. 53.8 cm²;
d. 37.5 cm².

Heuristic problems

Task 1. If a cylinder filled with water deflects by an angle α, 1/8 of the water flows out. If the cylinder deflects by an angle 2α, another quarter of the remaining water will flow out. Find angle α.

Task 2. A cylinder with radius R stands in a horizontal plane. Another one with radius r (r <R) is placed on a larger cylinder, as shown in Figure 1.

Describe the space locus where point A can appear.



Points B, C, D are adherent points of the cylinders.

Figure 1

Criteria for assessing practical assignments

The correct answer to a stereotyped task is estimated at 1 point. The assessment range of heuristic tasks is 0-4 points:

1 point – the task is not solved, but basic formulas necessary to solve the problem are given, a graphic layout of the task is drawn;

2 points – the task is half-solved: a graphic layout of the problem is drawn, basic formulas necessary to solve the problem are given, calculations for solving the problem are made partially;

3 points – the task is solved correctly but not fully justified;

4 points – the task is solved correctly, fully justified and proved, with a graphical representation of the decision result.

In order to conduct the pedagogical experiment and evaluate the effectiveness of ICT use in the educational process, a control group (students who studied the topic "Cylinder Volume" without using ICT) and an experimental group (students who studied the topic using Microsoft PowerPoint, Microsoft Excel, AutoCAD) were formed. In order to ensure the experimental outcome integrity, the control and experimental groups were formed in such a way that the average level of students' progress in geometry was approximately the same for both groups (Berlinski, Busso, 2017).

The index of stereotyped problems reliability for knowledge assessment on the "Cylinder Volume" topic, calculated by formula 3, is 0.77; the validity index (formula 4) is 0.71, which testifies of this test applicability to students' knowledge assessment.

The validity index was also calculated for heuristic problems. At the same time, the correct answer to such a task scored 4 points. The validity coefficient for was 0.97 the first heuristic task and 0.99 for the second one. Consequently, the proposed test is applicable for assessing the level of students' knowledge in the "Geometry" discipline when studying the topic "Cylinder Volume".

The average score of the students' knowledge test results in the control and experimental groups was 7.4 points for the control group and 8.9 points for the experimental group.

As shown by the pedagogical experiment, a significant difference in the levels of knowledge between the two groups of students was observed when solving heuristic tasks: 3.9 points (control group), 5.1 points (experimental group).

The coefficient of ICT use effectiveness calculated by formula 6 was 1.09for solving stereotyped problems and 1.31 for heuristic ones.

To test statistical significance of the differences in the level of knowledge gained by the students in the control and experimental samples, Pearson's chi-square test (χ^2-test) was used (equation 5). Based on the calculation results, an excess of the χ^2-test calculated value (7.73) over the tabulated one (3.84 at a significance level of 0.05) has been determined, which indicates statistical significance of differences in the level of knowledge of the control and experimental group students.

4. Discussion

Thus, the effectiveness of using such software products as Microsoft PowerPoint, Microsoft Excel, AutoCAD in the process of teaching geometry in the secondary education system has been confirmed by the outcome of the pedagogical experiment, especially in terms of formation of creative, analytical, and spatial competencies in students. The average grade in geometry in the experimental group of students exceeds its level in the control group by 1.5. The use of ICT has proved to be especially effective in performing heuristic geometry tasks, whereby the level of the experimental group knowledge exceeds the level of the control group by 1.2 points.

An essential advantage of using Microsoft PowerPoint, Microsoft Excel, and AutoCAD in the process of forming geometric competency is to ensure applied nature of learning as the main problem of studying geometry in the present day Russian secondary education system. Its applied nature is ensured by individualization of learning and intensification of students' independent work, an expansion of the assignments scope in class and of information flows when using the Internet. In other words, the use of ICT contributes to a more intensive study of the academic discipline over the standard time allocated for geometry studies. This approach can solve such an existing problem as teaching the fundamentals of solid geometry in preceding grades, for example, in the 8th-9thgrades.

The use of ICT gives new opportunities to the teacher, allowing them together with the student to enjoy fascinating cognitive process, to delve into a vivid colorful world by means of advanced technologies. Such an activity causes emotional uplift in children; even slow learners are willing to work with computers (Mukminova, 2016).

Integration of a regular geometry class with ICTs, in particular, with software products Microsoft PowerPoint, Microsoft Excel, AutoCAD allows the teacher to shift part of their work to the computer, thereby making the learning process more interesting, diverse, and intense. In particular, the process of writing down definitions, theorems, and other important material is speeded up, since the teacher does not have to repeat information several times (instead, they screen it), whereas the student does not have to wait until the teacher repeats exactly the fragment they need.

This approach to teaching provides many advantages for teachers: it helps them to better assess children's abilities and knowledge and to understand them, encourages them to look for new, unconventional forms and methods of teaching, and stimulates professional growth and further development of ICTs in the teaching process (Heitink et al., 2016).

The use of computer tests and diagnostic kits in class would provide an insight for teachers into the level of the studied material acquisition by all students in a short time and to adjust it in a timely manner. At the same time, it is possible to select the complexity level of a task for a particular student

In lessons integrated with ICTs, students acquire computer literacy and learn to use one of the most powerful modern universal tools, a computer, to work with geometry material, whereby they solve equations, construct graphs and diagrams, prepare texts and drawings for their papers. This is an opportunity for students to show their creative potential (Rambousek et al., 2015). It means that the use of an interactive geometric environment contributes to a student's personality development: inuring self-control and self-reflection in students, changing their role in the educational process from being passive observers to becoming active researchers. The quality of mathematical training also increases through the development of logical, heuristic, algorithmic thinking and spatial awareness in students.

However, along with the positive aspects of ICT use in the process of teaching geometry in the secondary education system, there are various problems both in preparation for such lessons and in class.

One of the main problems of effective ICT use in teaching school students is the facilities and equipment in Kazakhstan schools that are not sufficient for teaching such classes. As of 2017, Kazakhstan ranks 75th in the world in terms of ICT use in education (Almaty Education Department, 2013). Computer availability in schools of the country is 25 %, which means one computer per 12 students (Ministry of National..., 2018). An exit strategy for the current situation could be implementation of the following measures:

–teachers forming a geometry training agenda in computer classrooms for a semester or for the entire academic year by reference to time necessary to use computers for educational purposes;

–heightened interest in the use of information technology in learning other disciplines, not just mathematical ones by organizing and demonstrating lessons using ICT, developing creative assignments, publishing information about grade and school achievements online, organizing various competitions using multimedia and useful software products.

The next factor restraining ICT introduction in the learning process is strict compliance with sanitary-engineering standards for a personal computer use in geometry classes. Since a prolonged computer use is quite harmful for the child's body, it is necessary to fix optimal time limits for its usage (Miidla-Vanatalu, 2014). In this case it will be expedient:

–for the teacher to specify a list of geometry topics, the study of which is a priority with the use of ICT;

–to involve a wide range of programs in the learning process without requiring additional programming knowledge;

–to accurately plan geometry lesson stages using ICTs as much as possible according to the permissible standards of computer usage time by students (Miidla-Vanatalu, 2014).

Also, a significant destructive factor in extensive ICT use in training is a competition with the conventional learning technology. First of all, this problem is accounted for the lack of a major teacher interest in the use of computer technology in class. In this regard, it is necessary to take a purposeful action in respect to teachers: to ground them in computer literacy; to introduce them to specialized software intended for the educational process; presentation of the advantages of ICT use in geometry classes, in particular, of such software products as Microsoft PowerPoint, Microsoft Excel, AutoCAD; preparation for testing (for example, the Unified State Examination) using computers; centralized inclusion of certain sections or tasks that require the use of ICT in geometry textbooks, and other.

An immature student culture of operating a personal computer also leads to negative implications in the ICT-based learning process. Currently, the main purpose of using a computer by students is leisure activities: online networking, games of various kinds and so on. It is the main teacher's role to demonstrate the usefulness of a computer and various software products in the learning process. Therefore, the following seems expedient for the teacher to do: to clearly set learning objectives for students before starting work on a computer; to demonstrate an extensive use of computers and ICTs as supporting aids in teaching.

5. Conclusion

Thus, the following inferences can be drawn based on the empirical investigation:

1. The key problems of geometry studies in the present day secondary education system in the Republic of Kazakhstan are the following: the lack of a fundamental educational base for studying solid geometry in the form of a logical connection with plane geometry for secondary school students and an insufficient level of applied orientation of the training course. These destructive factors reduce the level of students' comprehension of the connection between solid geometric figures and the surrounding three-dimensional world, as well as the applicability of school geometry knowledge in practice.

2. The established effectiveness criteria for software products use have led to the conclusion that Microsoft PowerPoint, Microsoft Excel and AutoCAD are the most appropriate in studying geometry in the secondary education system. Integrated use of ICT data ensures applied nature of the academic discipline "Geometry" and contributes to the most complete formation of the geometric competency in students.

3. Advanced planning of geometry lessons in computer classrooms, accurate planning of ICT lessons, increased level of teachers' computer literacy and fostered motivation for ICT use in

teaching geometry will help to eliminate competition with conventional learning technologies and to mainstream effective software products into the educational environment. It will ensure intensification of independent and creative work of students in the learning process as a factor in formation of practical geometric competencies.

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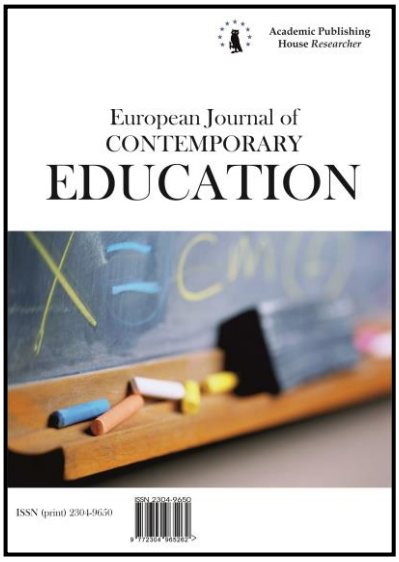
Published in the Slovak Republic
European Journal of Contemporary Education
E-ISSN 2305-6746
2018, 7(3): 581-597
DOI: 10.13187/ejced.2018.3.581
www.ejournal1.com



Developing Cognitive Independence of Future Informatics Teachers by Multimedia Tools

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Abstract

Future Informatics teachers need to have skills and abilities to continuously improve their knowledge in the field of both modern Information Technologies and modern methods of teaching Informatics. Specialists should constantly self-study because of the rapid pace in development of Informatics and Information Technologies. Thus, the high level of cognitive independence gives students real opportunities to integrate into the world information space, operating information resources presented in various forms. A new learning technology based on subject- and problem-oriented computer training programs and, in particular, multimedia programs is one of the ways to train highly qualified specialists. The programs help to improve the efficiency of learning technology, to intensify educational process, to improve the quality of training. At the same time, it is the role of an Informatics teacher that is significantly increasing. However, modern courses of Informatics do not adequately reflect the issues related to the theoretical and practical aspects of multimedia technology. This article describes our experiment on developing the components of cognitive independence of future Informatics teachers through learning, development and practical use of multimedia tools and gives the details of the used diagnostic material.

Keywords: cognitive independence, multimedia, diagnostics, Informatics teacher, motivation, experiment.

1. Introduction

Pedagogical education is modernized in order to provide high professionalism, pedagogical and professional culture of a specialist who receives a bachelor's degree in accordance with the modern requirements of information society and the demands of pedagogical practice (Ministry of Education et al., 2010). Rapid constant changes in the content of the subject "Informatics" determine changes in professional university training of a future Informatics teacher.

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At the same time, not just a well-educated specialist is in demand in the labour market, but a specialist who has qualities necessary for continuous improvement of knowledge in addition to professional skills (Abrami et al., 2015; Delen, Liew, 2016). Future Informatics teacher needs knowledge both in the field of modern Information Technologies and methods of their pedagogical application (Novković-Cvetković, Stanojević, 2017). A future teacher needs to adapt to a rapidly changing environment because of the limited possibility of mastering the new content of the subject at a faster pace in the university (Torabi et al., 2013). It means that it is necessary to master the skills of continuous self-learning (Arsić, 2014; Zanden et al., 2018).

Thus, the high level of cognitive independence gives students real opportunities to integrate into the world information space and participate in professional information processes, operating information resources presented in various forms, and use multimedia tools of presenting information for self-expression (Kazachenok, 2017; Milková, 2012; Rusakov et al., 2017).

The powerful computer multimedia systems and interactive computer programs have become the basis for intensive development of the content and principles of creating electronic textbooks, training programs, their usage on the basis of mobile devices (Sakibayev, Yakimchuk, 2017; Folley, 2010), tablets (Duran, Aytaç, 2016; Chen, Sager, 2011) for self-education of students, as well as their use in blended (Dalal, 2014; Yap et al., 2016) and distance learning (Kazachenok, Mandrik, 2011; Kazachonak, Mandrik, 2009).

Simultaneously, a number of researchers develop some issues related to a cognitive load in multimedia education (Mayer et al., 2004; Sorden, 2005; *Davies*, *Cormican*, 2013; Kalyuga, 2013), principles of multimedia education (Mayer, Moreno, 2003), as well as the use of multimedia technologies in the university pedagogical process (Kalyuga, 2013; Schnotz, Rasch, 2005) and their impact on formation and development of learning motivation (Folley, 2010; Vanslambrouck et al., 2018) and individualization of learning (Schnotz, Rasch, 2005; Casillas et al., 2016).

In these circumstances, it is of paramount importance for future specialists to develop the need in constant renewal and updating of knowledge in Informatics, and skills to meet this need (Milková, 2015; Dalal, 2014). Mastering new content of the subject area “Informatics” is possible only when all components of cognitive independence develop as a whole. Therefore, in the experimental part of our study we tested the process when future Informatics teachers were developing the components of cognitive independence, and the level of the education content that students were acquiring. We identified informative, operational, motivational, emotional-volitional and reflexive components in the structure of cognitive independence.

2. Materials and methods

To diagnose the levels of cognitive independence, we have developed a set of indicators, control and ascertaining materials (tasks, tests).

The indicator is considered as a component of a criterion, i.e. a specific indicator of qualities of a process or phenomenon (Borodin et al., 2015). For example, we chose the indicators of the operational component for measurements based on the skills of creative activity listed by the authors N.V. Bordovskaya and S.I. Rozum (Bordovskaya, Rozum, 2011) in combination with the features of creative achievement of the goals by a teacher, distinguished by V. Ye. Peshkova (Peshkova, 2015).

Table 1 shows the totality of all indicators on the informative, operational, motivational, emotional-volitional and reflexive components of cognitive independence of future Informatics teachers.

Table 1. Indicators of the selected components of cognitive independence of future Informatics teachers

Components	Indicators
Informative component	General professional knowledge (psychological, pedagogical, methodological).
	The amount of knowledge acquired by students in Information Technologies and Informatics (general, special).
	The system of knowledge acquired by a student about the ways and methods of using multimedia tools for cognition, self-education.

Operational component	The ability to form a problem, set a goal, suggest a rational, original solution in professional activity.
	The ability to transfer the acquired knowledge and methods of activity to different situations (analogous, partially modified, completely new ones).
	Operative and independent reproduction of knowledge.
	The ability to effectively use multimedia learning tools.
Motivational component	Cognitive interest in the object of professional activity.
	The need for self-improvement and self-education in the field of multimedia tools.
	The need to overcome difficulties in learning.
Emotional-volitional component	Strong-willed efforts to complete educational and cognitive activity.
	Striving to overcome difficulties in learning.
	Willingness to adopt and implement independent solutions.
	Making independent decisions in both standard and non-standard pedagogical situations.
Reflexive component	Self-assessment of the level of professional competence.
	Analysis and correction of cognitive activity.
	The ability to change oneself for achieving success in independent cognitive activity (analysis and improvement of the relationship between goals, means and consequences of actions).
	Self-monitoring of the use of multimedia tools and the result of his/her cognitive activity

To measure each indicator, diagnostic materials (tests and tasks for execution) have been developed.

We have identified three levels of cognitive independence of future Informatics teachers: high, medium, low for each of the components.

When characterizing each level, we used such a concept as the degree of acquirement (V.N. Bespalko gives the term – the level of assimilation in his work (Bespalko, 1995), which implied the student's ability to perform certain purposeful actions for solving a certain class of problems associated with the use of the object of study.

In our study, the method of expert assessments was used to determine the completeness, consistency, awareness of knowledge (Dneprov et al., 2017). Experts, measuring the degree of development of the studied quality, assessed in accordance with three levels. The experts were teachers-methodologists of the Informatics and Methods of Teaching Informatics Department, the Department of Information Technologies and the Department of Pedagogy and Psychology, I. Zhansugurov Zhetysu State University (ZhSU) (http://zhgu.edu.kz/).

When carrying out the differential analysis, we used a “biparadigmatic” approach, which allows combining quantitative test results with survey data, study of activity products, as well as with the results of oral questioning and interviews. We used statistical methods to empirically confirm the validity of the study results.

During the courses “Introduction to pedagogical profession”, ‘Informatics”, etc., students were tested to check the development of cognitive independence on the first and second indicators of **the informative component**, questioned on availability (absence) of additional knowledge in the field of multimedia tools.

To achieve the greatest objectivity and reliability of information, we offered test tasks from each section of the courses. 500 test questions were developed and proposed covering all the topics studied for control and experimental groups for each course. 40 test questions to diagnose each student were selected by random sampling with the help of the software developed by us.

We divided into the levels in accordance with the assessment policy adopted in I. Zhansugurov Zhetysu State University in terms of the credit education system (Table 2). According to the grading scale, the following quantitative indicators were determined for the low,

medium and high levels: the high level is 90-100 points (excellent); the medium level is 75-89 points (good); the low level is up to 75 points (unsatisfactory, satisfactory).

Table 2. Grading scale

Letter scale grade	Numerical scale grade	Points	Traditional Grade System
A	4.0	95-100	**Excellent**
A-	3.67	90-94	
B+	3.33	85-89	**Good**
B	3.0	80-84	
B-	2.67	75-79	
C+	2.33	70-74	**Satisfactory**
C	2.0	65-69	
C-	1.67	60-64	
D+	1.33	55-59	
D	1.0	50-54	
F	0	0-49	**Unsatisfactory**

To determine the level of development of **the operational component**, we used:

- a method for analyzing the products of respondents' activity;
- a questionnaire to identify students' abilities to use the multimedia tools in education;
- the methodology for compiling a test material by students.

We were able to identify the level of *the fourth indicator* using the questions of the questionnaire "Multimedia tools in Education". Here are some of the questions in this questionnaire:

- Are you familiar with training computer programs? (A lot and constantly, insufficiently, no)
- Do you have any application programs, information technologies? (Sufficiently, only the simplest ones, insufficiently)
- Could you optimally combine traditional and innovative (active methods of teaching, the newest models in organization of educational process) methods and means of teaching during the period of pedagogical internship? (A lot and constantly, differently, insufficiently)
- Do you know how to use the Power Point program capabilities when completing SIS assignments (students' independent study) and in preparation for other forms of study? (To a high degree, sometimes, very rarely)
- Do you use the capabilities of other, not listed above, various software products when completing SIS assignments (students' independent study) and in preparation for other forms of study? (to a high degree, sometimes, very rarely)

We evaluated each answer as follows: to a high degree – 2 points; sometimes – 1 point; very rarely – 0 points. The levels of the fourth indicator were distributed according to the points scored (the high level is 16-22 points, the medium level is 11-16 points, the low level is less than 11 points).

The boundary levels of all the studied indicators were selected in accordance with the recommendations of Ye. Sidorenko to identify differences in the level of the feature studied (Sidorenko, 2002, chapter 2).

We used the assessment based on the analysis of the students' project products (presentations, thematic booklets, sites) according to the requirements for multimedia projects to determine the levels of the *second and first indicators* of the operational component of students' cognitive independence.

Project-oriented tasks were developed and proposed for students in each course (Programming, Programming C ++, Computer Architecture, Computer Graphics, Modeling Basics in 3D MAX, Non-traditional methods of teaching Informatics). Here are some of the tasks:

1. Demonstrate how the inkjet printer devices function using the capabilities of 3D MAX program.

2. Develop and simulate animation materials on the topic "The principles of building local computer networks" by the tools of PowerPoint 2010.

3. Using C ++ language, develop and write a program that displays an animated model of the map of the Republic of Kazakhstan.

4. Record a mini-video lecture on the topic: "Basic methods of array sort".

Moreover, we adhered to the requirements proposed by the authors N.K. Solopova and O.V. Vyazovova (Solopova, Vyazova, 2010), which included an assessment of the technological, informative and ergonomic levels of the project (20 points, 50 points, 15 points according to each level).

Quantitative indicators for the low, medium and high levels are selected as follows: the high level is 57-85 points; the medium level is 29-56 points; the low level is up to 28 points.

To determine the levels of *the third indicator* (operational and independent reproduction of knowledge), we used the diagnosis of students by compiling tasks in a test form for each unit of educational material. The methodology of students' participation in test compilation encouraged them to independence and self-development. At the same time, the student's learning success was evaluated without comparison with others. It gave an opportunity to self-evaluate the learning success (Maltseva, 2002). Table 3 presents criteria evaluation for compiling test tasks. The quantitative indicators for the low, medium and high levels are as follows: (based on criteria evaluation according to a 10-point scale) the high level is 9-10 points; the medium level is 7-8 points; the low level is up to 6 points inclusively.

Table 3. Criteria evaluation for compiling test tasks

Criteria	Maximum number of points
Completeness of the task performed (15-20 questions on the topic covered)	1
Compliance of the test material with the topic studied	1
Coverage of all the concepts and definitions of the topic studied	1
Identical plausibility of answers to the test task, i.e. incorrect answers should be plausible	1
Maximum clarity of the text (no discrepancy)	1
Brevity (up to 12 words)	1
Simple stylistic layout	1
All answers, correct and incorrect, should have approximately the same number of words	1
Associations facilitating selection of the right answer are excluded	1
The extra words ("in the figure above", 'from the examples listed") are excluded	1
Total	**10**

Also, to determine the levels of *the third indicator*, SIS assignments were analyzed and evaluated in accordance with the grading scale of the credit education system (Table 2).

We used questionnaires "Diagnostics of the level of partial readiness for professional and pedagogical self-development" (Fetiskin et al., 2002) and "The demand for self-improvement and self-education in Information Technologies and multimedia tools" to evaluate **the motivational component** of cognitive independence and to determine the levels of the component's indicators. Here are some of the questions from this questionnaire:

1. Does the learning process at a university have a significant influence on formation of your demand to acquire knowledge in the field of multimedia tools?

2. What role in training future teachers do you assign to new information technologies?

3. Do you use new information technologies independently in your learning process?

4. Do you need to acquire new knowledge in multimedia tools?

We evaluated each answer as follows: highly is 2 points; sometimes – 1 point; very rarely – 0 points).

To measure the level of indicators of the **emotional-volitional component**, we used the questionnaires "Diagnostics of the level of partial readiness for professional and pedagogical self-development" (Fetiskin et al., 2002) and the methodology "Diagnosis of communicative and organizational inclinations (COI-2)" (Fetiskin et al., 2002: 184). This method is designed to identify communicative and organizational inclinations of an individual (the ability to clearly and quickly establish business and friendly contacts with people, the desire to expand contacts, participate in group activities, the ability to influence people, etc.). The tools that diagnose the indicators of the emotional-volitional component were chosen due to the fact that these techniques, developed specifically to identify the indicators we are considering, have the full scope of their content.

To measure the level of indicators of **the reflective component**, we used the test "Reflection on self-development" according to diagnostics of the level of self-development and professional-pedagogical activity by L.N. Berezhnova (Fetiskin et al., 2002). Quantitative indicators for low, medium and high levels were determined according to the processing and interpretation of results on the scales "Level of aspiration for self-development", "Self-evaluation of one's personality", "Self-assessment of the level of ontogenetic reflection", "Diagnostics of implementation of needs for self-development", proposed by the authors of the test.

We used the presented diagnostic materials and methods to measure the level of the studied quality development both at the stating stage of the experiment and at all stages of the forming experiment with small adjustments.

Students majoring in Informatics, who were studying at the Faculty of Physics and Mathematics from 2011 to 2017, participated in the experiment. In total, there were 150 participants including 76 students in the control group, where the traditional teaching method was practiced, and 74 students in the experimental group, where experimental methods were used in teaching. 30.7 % of male and 69.3 % of female students participated in the experiment.

The students were divided into experimental and control groups in two stages.

At the initial stage, first year students, who participated in the experiment (more than 95 % of them enrolled the university right after school or college), were divided into three clusters: 1) graduates of privileged educational institutions (lyceums); 2) graduates of urban secondary schools and secondary schools-gymnasiums; 3) graduates of colleges and rural schools.

At the second stage, students were distributed to the experimental and control groups for each cluster, if possible, evenly, by random selection, and separately for boys and girls. The name of each applicant was recorded into a private card. After mixing the cards, we randomly took the necessary number of cards. The students, whose names were on the selected cards, were distributed to the experimental group, the rest – to the control group.

Identification of the initial conditions was based on the following parameters: the students of the experimental and control groups studied at the same university (identity of technical support), the subject was taught by one teacher according to a single program approved by the ZhSU Academic and Methodological Council. In addition, initial teaching of Informatics students was identified by preventive activities that took place in the course of studying the courses "Informatics", "Introduction to the pedagogical profession" before the experiment began.

Before the beginning of the experiment, the characteristics of the initial training state for these courses in the experimental and control groups coincided with the significance level of 0.05 according to Fisher's statistical criterion (a detailed description of the methodology for applying the criterion is described below).

In particular, the number of students with a high and average score in the control group was 35 (46.1 %), in the experimental group – 34 (46.0 %).

We proposed the introduction of an appropriate methodology for developing cognitive independence of future Informatics teachers by multimedia tools to improve the quality of their teaching in the field of modern Informatics.

To determine the most effective forms and methods of teaching, taking into account the specifics of multimedia tools (Mayer et al., 2004; Mayer, Moreno, 2003) and the specifics of the

major "Informatics" (Dalal, 2014, Majherová, Králík, 2017), a forming experiment was conducted with these groups of students. The experiment was conducted on the premises of I. Zhansugurov Zhetysu State University.

The purpose of the forming experiment was to test the effectiveness of the developed methodology described below.

To achieve this goal, the following tasks had to be solved:

- to compare the results of the initial state analysis and the results of the forming experiment;
- to reveal dynamics of results of developing students' cognitive independence by multimedia tools;
- to conduct a differential analysis on effectiveness of formation of the studied quality by statistical methods;
- to draw conclusions and make recommendations on the further use of the developed methodology.

Next, we briefly outline the content of the appropriate methodology, implemented in the teaching and educational process of the university by stages (**theoretical, integrating, practical ones**). The first stage (theoretical) lasted two semesters (3, 4 semesters) of the second year, the second stage (integrating) lasted two semesters of the third year (5, 6 semesters), the third stage (practical) lasted two semesters of the fourth year of study (7, 8 semesters).

The purpose of the methodology is to develop cognitive independence of future Informatics teachers by multimedia tools: to deepen and systematize students' knowledge base in the field of multimedia; to shape a positive attitude to the use of multimedia, to develop skills to create multimedia tools with the help of computer programs and it is advisable to apply various types of multimedia products in their future teaching activities.

At **the theoretical stage** of the methodology, conscious motivation is developing to use multimedia in the process of students' independent cognitive activity by using various types of multimedia support. The main task of the **integrating stage** is to give knowledge and develop skills by major subjects by developing multimedia tools. The final stage in developing cognitive independence of future Informatics teachers is the **practical stage**, when students can apply multimedia technologies in pedagogical activities.

The experimental group students used updated academic programs of basic and major courses, as well as a special course and a program of pedagogical internship. The renewed topics of the courses under study did not break the logics of main topics, harmoniously merged into their content; in addition, the titles of main topics and the total number of hours according to the curriculum were not changed. Details of each innovation will be described below by the implementation stages. The control group was taught using traditional forms, methods and techniques of teaching; the topics of subjects were not changed in academic programs.

When choosing methods and means for the purposeful developing cognitive independence of future Informatics teachers, we used the experience of applying blended learning technology to improve the quality of teaching (Folley, 2010; Yap et al., 2016; Vanslambrouck et al., 2018). In contrast to the control groups, in addition to the traditional means, forms and methods of teaching, students of experimental groups did SIS assignments using different multimedia tools that we developed and tested (electronic textbooks on the subjects studied, lessons for interactive whiteboard, interactive schemes, etc.). In particular, multimedia educational and methodical complex (MEMC) "Multimedia in education", as well as renewed teaching methods and techniques. We will give their description and clarify the peculiarities of their application at different stages of developing cognitive independence of future Informatics teacher. The control group was provided only with traditional data storage media (methodological aids, textbooks, problem books, etc.).

Theoretical stage of developing cognitive independence of future Informatics teachers.

Teachers who taught the experimental group had a seminar "Multimedia support for SIS assignments" at the first year of study. The topics of the academic programs on the courses Programming (2nd year, 3rd semester) and Programming C ++ (elective course) (2nd year, 4th semester) were updated. For example, the following topics of the course "Programming" are

supplemented with multimedia content: “Graphics in Pascal language”, "Graphic and multimedia information display”, etc.

***Multimedia tools*:** At this stage we used electronic multimedia textbooks “Programming”, “Programming C ++” intended for students to independently master theoretical and practical units of courses using up-to-date computer visualization tools that contain various level practical tasks. The text material of each topic is supplemented by video and audio materials.

Besides textbooks and problem books on traditional media, students of experimental groups used 7 independent lessons developed for an interactive whiteboard in order to support practical and laboratory lessons (Molina, Sampietro, 2015; Yakimchuk, 2009). Each lesson concerns a certain topic on programming.

In addition to these textbooks for additional multimedia support of lecture classes, we developed a set of mini-lectures on the above course s (Folley, 2010; Whatley, Ahmad, 2007). Each video file lasting 10-15 minutes is a “screencast” for studying the most difficult for understanding parts of the theoretical material of course s, for example, on the topics "Recursion", "Sorting arrays", etc.

***Methods and techniques of the theoretical stage*:** Along with traditional methods and techniques, we actively used associative methods at various stages of classes: actualization of knowledge, independent study of new material, checking the studied material in the form of SIS (students’ independent study) assignment. The methodological purpose to apply associative methods (intelligence maps, associograms, etc.) was students' independent application of complex knowledge in their interrelationship, development of the skills of graphical representation and structuring of knowledge.

The integrating stage of developing cognitive independence of a future Informatics teacher.

The topics of academic programs on the courses “Computer Architecture” (3rd year, 5th semester), “Computer Graphics” (3rd year, 6th semester) were updated. For example, the topic “Multimedia systems” was included in the unit “Specialized computers” of the standard program of the course “Computer architecture”, and the topic “Adobe Photoshop tools for creating animations” was included in the academic program of the course “Computer graphics”.

***Multimedia tools*:** we used the electronic multimedia textbook “Computer Graphics”, designed for students to self-study such units of the course as “Raster Editor Adobe Photoshop” and “Vector Editor CorelDRAW”. The textbook includes materials in video, audio, and text formats.

The set of mini-lectures or screencasts lasting 10-15 minutes was developed as an supplementary tool for studying the most difficult practical techniques of working with computer graphics editors, for example, “Creating lines in Corel DRAW object model”, “Masks of complex Adobe Photoshop objects”, and so on.

Taking into account the necessity and importance of gaming activities in learning (Veličković, 2013; Gómez, Barujel, 2017), during studying the course “Computer Architecture”, we used a multimedia teaching game developed in the Delphi programming environment (Yakimchuk, 2011). This is a full-fledged computer game, which has its own storyline, script and game world.

Methods and techniques of the integrating stage: at this stage we used the method of the thematic multimedia portfolio. At the beginning of the semester students received the topic and, during the course, collected multimedia materials that they were developing (screencasts, flash animations of various directions, presentations, etc.). Using this method, students could apply knowledge and skills acquired in previously studied courses, such as, for example, web technologies and Internet programming. They could finalize the portfolio at the end of the semester and present interconnected web pages with multimedia content.

The practical stage of developing cognitive independence of a future Informatics teacher of computer science.

At this stage, the topics of the academic program on the course “Fundamentals of Modeling in 3D MAX” (4th year, 7th semester) were updated; a specialized course “Non-traditional methods of teaching Informatics” and a program of pedagogical internship (4th year, 8th semester) were developed and tested.

***Multimedia tools*:** We used the electronic textbook "Fundamentals of Modeling in 3D Max" at all types of lessons, along with full (50 minutes) video lectures on study of lecture material (tools and program commands). The textbook contains screencasts for performing thematic laboratory tasks, and a set of ready-made three-dimensional models.

The specialized course "Non-traditional methods of teaching Informatics" was supported by MEMC "Multimedia tools in teaching". The MEMC gave opportunities for students to acquire professional knowledge both under teachers' supervision and independently, so it was used both in a classroom and for SIS and TSIS (students' independent study and students' independent study with teacher) as required by the credit education system. When developing multimedia tools, we made an emphasis on students' independent study, their team work, mini-research of various levels, activation of cognitive activity. It should be noted that the developed MEMC combined the properties of an ordinary textbook, reference book, laboratory manual and an expert of the acquired information.

***Methods and techniques*:** We used an innovative Case study method in teaching Informatics combining it with other methods. The Case study method perfectly complements traditional methods at seminars and TSIS in developing independent cognitive activity skills of future Informatics teachers in study of multimedia technologies for their future pedagogical activity.

At the preliminary stage, the teacher distributed case studies describing the mechanism for further work, clearly defined goals, tasks and the rules of work for each stage; the questions to be answered, the criteria and principles of evaluation were called.

The Case study method was based on students' independent study. Firstly, students received information on the case (specific learning "problem", which is described in a specific period of time, revealed and clearly formulated with the aim of diagnosing and self-decision), its analysis and interpretation, and then they searched for possible solutions to the situation. After students formed an independent view of the situation and found solutions, they were united in small groups and shared the results of independent work, received feedback, developed the optimal solution to the problem, presented their results to other small groups. At the end of this work the teacher summed up with a few comments and remarks directly on the content of the situation (solutions, key provisions of the pedagogical situation, problems) and on other aspects (e.g., interesting points of presentations, creative findings, and analytical thinking). At the end of the lesson, each member of the group was evaluated, their grades were explained.

The method of projects was the leading method of performing independent work at this stage (Fernández et al., *2013*). The choice of the educational project topic and the beginning of its implementation were organized in parallel with the laboratory and practical classes. The project was implemented in parallel with study of the course: at the current lesson students studied the material on implementation of a certain stage of the corresponding project. In the course of the experiment, on the basis of the analysis of the curriculum for the major "Informatics", variants were developed for the content of projects from different subject areas, taking into account interdisciplinary connections, in which elements of the fundamentals of multimedia technologies can be studied.

At this stage of experimental work with students, during pedagogical internship, one of the main and most effective forms of work on developing the motivational component of students' cognitive independence was the interest group' program for schoolchildren "The World of Multimedia." Students supervised the sections of the interest group: "Web-masters", "Researcher", "Computer graphics and animation".

3. Findings

Thus, the method of developing informative independence of future Informatics teachers by multimedia tools has the following **unique features**: firstly, we relied on the use of different types of multimedia support as a source of training materials, learning tools, and so on; secondly, the use of multimedia tools as the teaching method indirectly – as a final product of students' work in acquiring knowledge and skills in various courses.

The role of multimedia as a means of teaching is expanding at each subsequent stage in developing the cognitive independence of future Informatics teacher. At *the initial stage* it is a means of visual presentation of educational material. At the *integrating stage* students learn the

technology of creating various multimedia tools (including interactive ones) in addition to using multimedia as a means of visual representation. At *the practical stage*, future Informatics teachers carry out creative multimedia projects, both group and individual ones, during the course "Non-traditional methods of teaching Informatics". The projects were later used in teaching practice in classrooms and supervising schoolchildren's interest groups. For this, students use all the knowledge and practical skills acquired at the previous stages.

This distribution of the role of multimedia tools in the process of training the future specialist allows us to achieve the goal of each stage of the methodology for the formation of the desired personal education.

Table 4 indicates the results of the final assessment after three stages of the experiment (where IS is initial state, E is the results of experimental groups, C is the results of control groups). The integrative indicator shows the arithmetical average of the numerical values of all five components of cognitive independence.

Table 4. The results of developing components of cognitive independence of future Informatics teachers by multimedia tools (in %).

Components	High level			Medium level			Low level		
	IS	E	C	IS	E	C	IS	E	C
		3	3		3	3		3	3
Motivational	14,0	24,3	17,11	35,2	63,5	40,79	50,8	12,2	42,11
Informative	15,4	33,8	26,32	40,1	58,1	47,37	44,5	8,1	26,32
Emotional-volitional	4,1	12,16	6,58	44,9	78,38	50,00	51,0	9,46	43,42
Operational	9,9	27,03	18,42	21,5	60,81	30,24	68,6	12,16	51,32
Reflexive	3,1	12,16	6,58	44,9	78,38	51,32	52,0	9,46	42,11
Integrative indicator	**9,30**	**21,89**	**15,00**	**37,32**	**67,84**	**43,94**	**53,38**	**10,27**	**41,06**

According to the analysis, the results of developing cognitive independence components are interdependent in the experimental group using the Pearson correlation coefficient (Grabar, Krasnyanskaya, 1977). The analysis showed their statistically significant pair correlation (significance level 0.05). Such a result was not observed in the control group.

Let us consider the results of effectiveness analysis in developing *the motivational component* of the future Informatics teachers' cognitive independence. The results of effectiveness analysis in developing emotional-volitional and reflexive components, as well as the third indicator of the informative component and the fourth indicator of the operational component are similar.

In order to determine the significance level of differences in the effectiveness of training students in the control and experimental groups, we carried out research and statistically processed the results of observations. We assumed as a null hypothesis (H^0) that the offered method of developing components of cognitive independence of future Informatics by multimedia tools does not give advantages in comparison with the traditional method of teaching future Informatics teachers at university. An alternative hypothesis (H^1) corresponded to the assumption that the offered method of developing components of cognitive independence of future Informatics by multimedia tools has advantages in comparison with the traditional method of teaching future Informatics teachers at university.

To compare the results of the final assessment we used the Fisher criterion φ, designed to compare two samples according to the frequency of the occurring effect (Novikov, 2004). The criterion estimates reliability of the differences between the percentages of the two samples in which the feature of interest is registered. To obtain quantitative estimates, let us specify the hypotheses formulated above:

H^0: studies in the experimental group do not help achieve the high and medium levels, that is, the quality of knowledge is not higher than in the control group.

H^1: studies in the experimental group help to achieve the high and medium levels, that is, the quality of knowledge is higher than in the control group. The data are given in Table 5.

Table 5. The results of the experiment

Group	The number of students tested (n)	High and medium level (the number)	Percentage share
E	74	65	87,8
C	76	44	57,9

Using statistical tables, we determine the values of φ, corresponding to the percentage of each group: φ1 (87.8) = 2.43, φ2 (57.9) = 1.73. We calculate the empirical value of φ^0 by the formula 1:

(1)

$$\varphi^0 = |\varphi_1 - \varphi_2| \cdot \sqrt{\frac{n_1 \cdot n_2}{n_1 + n_2}}.$$

In this case we receive $\varphi^0 = 4.27$. To assess the significance of psychological and pedagogical effects, a level of statistical significance was used, $p \leq 0.05$, at which φ^0 (min) = 1.64. As a result, we receive $\varphi^0 > \varphi^0$ (min) with a significance level of $p \leq 0.05$.

Thus, reliability of the differences in the characteristics of the compared samples is 95 %. It allows us to state that hypothesis H^1 is proved: studies in the experimental group help to achieve the high and medium levels of the integrative indicator.

The dynamics of developing the first two indicators of the *informative component* of the future Informatics teachers' cognitive independence was checked by comparing the results of the final assessments at the end of each stage of the forming experiment.

The coefficient's average value of complete mastering the content of knowledge in Informatics and multimedia (q^*) was used as a measurement tool. This coefficient was determined at each mid-year assessment on the basis of the operational analysis developed by A.V. Usova. We adapted it to teaching in ICT (Menchinskaya, 1989):

(2)

$$q^* = \frac{\sum_{i=1}^{n} q_i}{nq} \cdot 100,$$

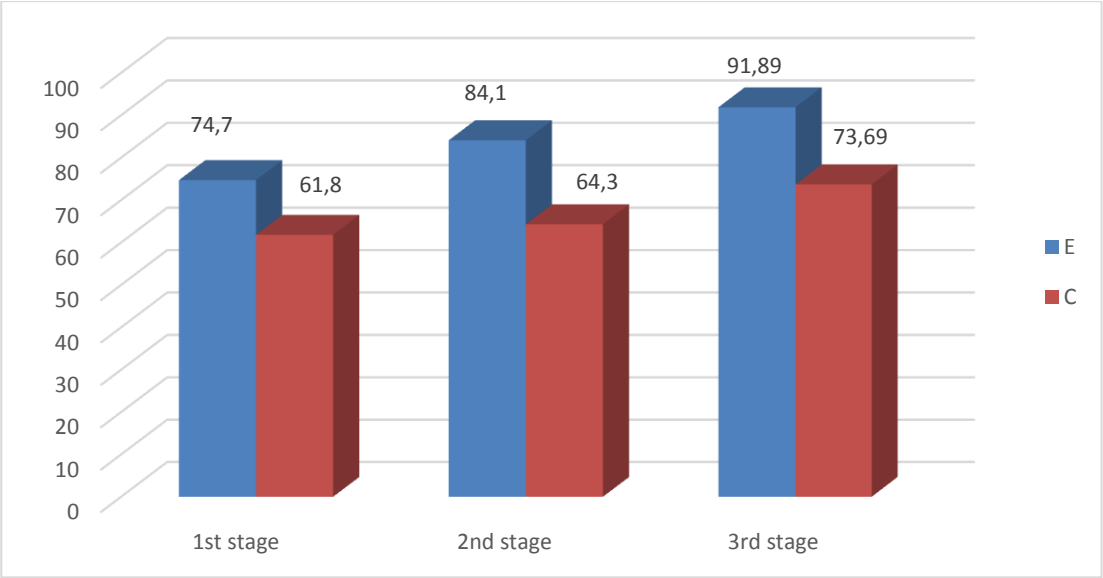
where n is the number of students performing work,

q_i is the number of correctly performed tasks by the i -th student at the corresponding stage of the experiment,

q is the maximum number of the tasks that must be performed.

Figure 1 shows the results of a comparative analysis.

The presented results visually testify to positive changes in a level of indicators of the *informative component* of future Informatics teachers' cognitive independence, which is much higher in the experimental groups, than in the control groups.



E is the experimental groups; C is the control groups

Fig. 1. Comparative characteristics of indicators of the informative component of future Informatics teachers' cognitive independence in the experimental and control groups (%)

In order to confirm the significance of differences in the effectiveness of teaching students in the control and experimental groups, a study was carried out and the results of observations were statistically processed.

To compare the results, we used Student's *t*-test (Klochko, 2003). The experimental data are given in Table 6. Here, the standard deviation was calculated according to the formula 3:

$$\sigma = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}\left(\frac{q_i}{q}\cdot 100 - q^*\right)^2}. \quad (3)$$

Table 6. The results of the experiment for indicators of the informative component of cognitive independence

Group	The number of students tested (n)		The coefficient's value q^*			Standard deviation σ		
			1st stage	2nd stage	3rd stage	1st stage	2nd stage	3rd stage
EG	74	53	63	72	12	13	16	
CG	76	52	57	59	12	15	19	

The significance criterion for testing the null hypothesis was based on computing sample statistics

$$t = \frac{q_1^* - q_2^*}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}, \quad (4)$$

where q_1^*, σ_1, n_1 correspond to the experimental group, and q_2^*, σ_2, n_2 – to the control group;

$\nu = n_1 + n_2 - 2 = 148$ is the number of degrees of freedom.

As a result of the calculations using the cognitive independence indicators for the first stage, we obtained $t = 0.51$. In this case, the table value t (tab) = 1.97 with a significance level of 0.05. For the second stage, we received $t = 2.62$, and for the third stage, $t = 4.54$

Comparison of the calculated values of t with the tabulated value at the corresponding significance level shows that if knowledge was approximately the same at the first stage in the experimental and control groups, then it was significantly different at the second and third stages.

It is worth noting that the preliminary verification of the null hypothesis about the normal distribution of values $\frac{q_i}{q} \cdot 100$ at the significance level $\alpha = 0.05$ was carried out using Pearson's agreement criterion χ^2 according to the formula:

$$\chi^2 = \sum_{i=1}^{k} \frac{(m_i - np_i)^2}{np_i}, \qquad (5)$$

Where m_i are frequencies,

p_i are theoretical probabilities,

$n = n_1$ or $n = n_2$, $k = 10$.

Similar results were achieved for the second and third indicators of the *operational component* of cognitive independence.

4. Discussion

The findings of the ascertaining experiment showed a fairly low initial level of development of students' cognitive independence. The teaching methods used earlier did not allow to provide a high level of the desired personal education.

Thus, the components of students' cognitive independence had to be purposefully developed through the use of specialized forms, methods and means of teaching used in study of basic and major disciplines and in pedagogical internship.

We developed and tested multimedia tools: interactive multimedia programming lessons for interactive whiteboards, a multimedia game, short video clips and animations in subjects (10-15 minutes), full video lectures (50 min) on topics, interactive schemes and multimedia textbooks on the above disciplines.

It should be noted that multimedia textbooks have proved to be the most effective means for studying subjects within practical classes and SIS. The textbooks have full-scale (50 min) video materials that provided methodological support to students when they did practical assignments. However, using video to support lectures, short animation fragments and "screencasts" (10-15 min) turned out to be more effective. We used them when studying material at various stages of classes.

We used the results of a study by Janice Whatley and Amrey Ahmad (Whatley, Ahmad, 2007) who experimented with different types of video lectures. When developing video fragments, the authors found out that eye contact with the lecturer should be encouraged during video recording by providing a direct view of the lecturer to the camera for most of the time. According to the results of their experiment, lectures recorded in a separate room exceeded those recorded in a classroom directly at the lecture due to the possibility to rehearse, improve the sound and remove extraneous noise.

In accordance with this, we used video fragments that were recorded both with the help of video capture programs from the screen, and with the help of a video camera with the possibility of rewriting and editing. In addition, using Adobe Flash software, we developed short (5-7 min) animation clips where some abstract notions of disciplines were visualized. These clips also proved their effectiveness.

In particular, we used such animation to visualize the programming techniques: "Sorting arrays", "The Tower of Hanoi problem", etc. Various authors have experimentally proved the effectiveness of using multimedia software to develop students' algorithmic thinking (Milková, 2015; Milková, 2012), to use robotic virtual environments in teaching future Informatics scientists programming (Majherová, Králík, 2017), etc. Also our experiment justified and proved the efficiency of multimedia software for study of the courses "Programming", "Programming C ++ ", "Fundamentals of programming for Robotics" (Yakimchuk, 2008; Yakimchuk, 2017).

A multimedia training game for the discipline "Computer Architecture", which was programmed in the Delphi environment, was the most laborious in terms of software development. Researchers (Veličković, 2013; Gómez, Barujel, 2017) emphasize that effective learning takes into account various psychological processes, such as attention, memory, motivation, emotions, etc. Educational games stimulate critical thinking, creative approach to problem solving and teamwork (Sampedro, McMullin, 2015). Thus, educational video games become an effective tool if applied to achieve the ultimate goal of the learning process. Due to the fact that our multimedia game had its own storyline (script, characters) and the game world, it had a significant impact on developing the motivational component of the future Informatics scientists' cognitive independence when studying in combination with other multimedia and scientific and methodological support.

Thus, we proved the effectiveness of the developed methodology by analyzing the process of forming components of future Informatics teachers' cognitive independence to improve the quality of their teaching in modern Informatics.

5. Conclusion

The positive dynamics of the experiment's results allows us to state that students systematically, completely and consciously acquire theoretical knowledge and develop their pedagogical skills due to the purposeful consistent work on teaching future Informatics teachers.

To effectively **implement** the methodology for developing cognitive independence of future Informatics teachers in terms of the credit system of education, we have identified the following **pedagogical conditions**:

- scientific and methodological support, development of a new content of education, taking into account the use of multimedia tools;
- development of future Informatics teachers' cognitive independence on the basis of modular technology, which allows students to independently achieve the goals of educational and cognitive activity;
- development and implementation of multimedia support for developing the cognitive independence of future Informatics teachers, which allows to provide an individual trajectory of its development.

Students could form the whole picture of new information technologies and multimedia thanks to a seminar for teachers and introduction of educational, methodological and multimedia support. Also they could improve necessary knowledge and skills to use them independently in professional activities.

The tests, questionnaires, and other methods for diagnosing the levels of cognitive independence of future Informatics teachers listed in the article were used to measure the individual components of the quality in question: informative, operational, motivational, emotional-volitional, and reflexive ones. The proposed tools are adapted as a whole to train future Informatics teachers to use multimedia in their activities. Currently, the specialized course that we developed and multimedia support of disciplines are widely used in the learning process of the university. The materials of the article can be useful to researchers involved in improving the quality of university education, as well as practicing teachers as a tool for determining the level of cognitive independence of future teachers in the learning process.

Thus, the experiment's results prove the effectiveness of the methodology that we developed. The received results of the research testify to the positive dynamics of improving the quality of their training in modern Informatics on the basis of developing components of cognitive independence, which proves the expediency of introducing the methodology that we developed s into the university learning process.

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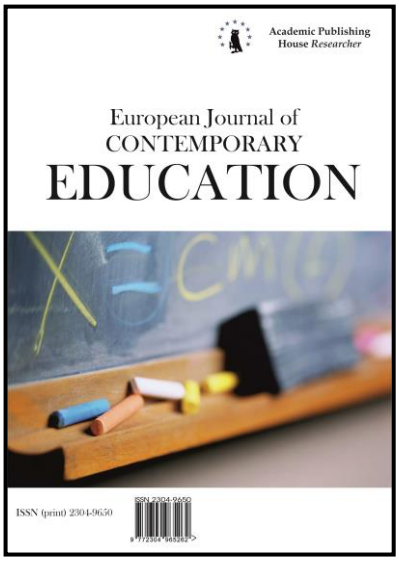
Published in the Slovak Republic
European Journal of Contemporary Education
E-ISSN 2305-6746
2018, 7(3): 598-607
DOI: 10.13187/ejced.2018.3.598
www.ejournal1.com



The History of Education

Public Education System in the Caucasus Region in the 1850s: Unification and Regulation of Educational Process

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Abstract

This article considers the public education system in the Caucasus region in the 1850s, i.e. at the time when unification and regulation of the educational process was taking place within educational institutions.

Statutory documents describing the public education system in the Caucasus during the middle of the 19th century were used as study materials. For example, such statutory documents include the Provisions on the Caucasus Educational District and, educational institutions reporting to it. In addition, the authors used compilations of published documents as well as specialist literature.

When resolving research tasks, the authors used both general scientific methods (analysis and synthesis, specialization, generalization) and conventional methods of historical analyses. The historical and situational method, which involves studying historic evidence in the context of the surveyed period in conjunction with the neighboring events and facts, is of extreme importance.

In conclusion, the authors note that the Caucasus region in the 1850s underwent educational process unification and regulation. Time of chaotic operations at gymnasiums and secondary schools ended and the population of the region was increasingly understanding the benefits of

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education. As the result, Caucasian schools were becoming increasingly similar to their counterparts in the inland areas of the Russian Empire. Nevertheless, evolution of the public education system in the Caucasus was taking place in view of the ongoing Caucasian War in the region. That is why mosque schools enjoyed a practically autonomous status, for the Russian Administration tried not to provoke the local Muslim population. In addition, the Caucasus region didn't have any mixed schools. That was also a regional feature of this area.

Keywords: public education system, Caucasus, Caucasus Educational District, directorates, the 1850s.

1. Introduction

As is known, the public education system of the Caucasus region in the 19th century underwent the process of its establishing and development. All schools available in the Caucasus region were united into a special school district in 1848, which was called the Caucasus district. This newly established district reported directly to the Sovereign's Vicegerent in the Caucasus region. Temporary Provisions and Staff Chart of the Caucasus School District were also issued in 1848. A number of activities were planned for the three following years to merge educational institutions of the Caucasus District with those of the internal provinces of the Russian Empire.

2. Materials and methods

Statutory documents describing the public education system in the Caucasus of the middle of the 19th century were used as study materials. For example, such statutory documents include the Provisions on the Caucasus Educational District and educational institutions reporting to it. Compilations of published documents (Complete collection of laws of the Russian Empire; Collection of laws of the Russian Empire; Collection of statistical information, 1869), special literature (Historical overview, 1902; Materials on history, 1942) were also used in addition.

When resolving research tasks, the authors used both general scientific methods (analysis and synthesis, specialization, generalization) and conventional methods of historical analysis. Historical and situational method, which involves studying historic evidence in the context of the surveyed period in conjunction with the neighboring events and facts, is of extreme importance.

3. Discussion

Proceeding with a historiography review, one should immediately give an explanation that it is not notable for multiplicity in view of the narrow time frame of the study. However, this chronological period was occasionally addressed in the studies on broader topics while studying the national public education system in the Caucasus region and in the Russian Empire in general. The most typical example is the work of N.A. Shevchenko, E.V. Vidishcheva, O.V. Emelyanova The Establishment of the System of Public Education in the Caucasus (1802–1917 years): The Characteristic Features (Shevchenko et al., 2016). While considering the national public education system, the authors include the period of time that we study, the 1850s, to the second chronological period (1835-1871). As the authors note, it was the time when the Russian Administration first tried to unify and centralize the educational process at schools in the Caucasus region (Shevchenko et al., 2016: 364, 366).

Legislation of the 1840–1870s in the field of public education in the Caucasus region was considered in the works by Ye.I. Kobakhidze (Kobakhidze, 2015). The author notes that thanks to the unified public education system in the Caucasus region, a class of local officialdom and commercial establishment was formed within a short period of time (Kobakhidze, 2015: 88).

The public education system of the Caucasus region in the 1850s is also reflected in other writings. Thus, for example, this topic was considered in a work by L. Modzalevskii who studied the public education history in 1802–1880. (Modzalevskii, 1880).

4. Results

The Provisions on the Caucasus Educational District and educational institutions reporting to it was approved on October 29, 1853. The Provisions consisted of nine chapters: 1) General rules, 2) On the Caucasus Educational District management, 3) On gymnasiums, 4) On boarding houses at gymnasiums, 5) On higher four-year colleges, 6) On district and county schools, 7) On initial schools, 8) On private boarding schools, private schools and home tutors, 9) Order of employment

and dismissal of the employees and advantages of their service (Complete collection of laws of the Russian Empire, volume 28. Part 1. No. 27646).

Administratively, the Caucasus Educational District was divided into four directorates: 1) The Tiflis directorate that included schools of Tiflis, Shemakha and Derbent provinces, 2) The Kutaisi directorate that included Kutaisi and Erivan provinces, 3) The Stavropol directorate that included Stavropol province, as well as schools on the right and left flanks and in the center of the Caucasian line 4) Lands of the Black Sea that included lands of the Black Sea Army and the area in the north-eastern part of the Black Sea coastline.

As of 1853, the Caucasus Educational District included the following educational institutions. The Tiflis Directorate:

1. The Tiflis provincial gymnasium with a boarding house;
2. Higher four-year college in Shemakha;
3. Demesnial commercial school in Tiflis
4. District schools in the cities: Gori, Signah, Telave, Elisavetpol, Nukha, Shusha, Baku, Derbent
5. Initial training schools: Dusheti, Tionet, Kuban, Lenkoran.

The Kutaisi Directorate:

1. The Kutaisi provincial gymnasium with a boarding house;
2. District schools in the cities: Akhalcykh, Alexandropol, Erivan, Nakhhichevan
3. Initial training schools: Ozurgeti (two-class school), Redutkali (two-class school), Kutaisi, Novo-Bayazet, Ordubadi and Racha.

The Stavropol Directorate:

1. The Stavropol provincial gymnasium with a boarding house;
2. District schools in the cities: Stavropol, Kizlyar, Mozdok, Georgievsk and Pyatigorsk.

The Black Sea Army Lands Directorate:

1. The Yekaterinodar military gymnasium with a boarding house,
2. District schools with a boarding house: Poltavskaya, Umansky.
3. District schools: Novorossiysk, Anapa, Yeysk.
4. Initial training schools: Ekaterinodar, Taman, Temryuk, Bryukhovetskaya, Shcherbinovskaya.

It is important to note that the Caucasus Educational District did not include church schools established for the children of the Orthodox and Gregorian-Armenian confessions.

Schools of the Caucasus Linear Cossack Host were also placed under orders of the Caucasus Educational District Administration.

Provisions on the Caucasus Educational District regulated: control procedures of the educational district, purpose and organization of gymnasiums, boarding houses, purpose and organization of higher four-year colleges, purpose and organization of district and county schools, purpose and organization of the initial schools, rules for private boarding schools, private schools and home tutors, as well as the order of employment and dismissal of the employees of the Caucasus Educational District and advantages of their service to the Caucasus school district (Provisions On The Caucasus Educational District, 1853: 32).

The Caucasus Educational District was managed by an Administrator who at the same time was a member of the Transcaucasian Region Head Department Council. The Administrator had an assistant. A public schools inspector, an architect and the secretariat were reporting to him.

The Administrator also managed a Censorship Committee. The Censorship Committee staff and their responsibilities were defined by the General Censorship Statute rules (Complete collection of laws of the Russian Empire volume XIV. P. 147).

The Caucasus Educational District Administrator enjoyed all the rights that were assigned to the Administrators of other educational districts. However, he addressed his proposals not to the Public Education Minister, but to the Sovereign's Vicegerent in the Caucasus region. If there was no Administrator, his duties were performed by the assistant.

The Educational District Council rendered substantial assistance to the Administrator. The Council consisted of a Chairman, who served as Administrator, and the Council member: Assistant Administrator, Public Schools Inspector, Principal of the Tiflis province schools and Principals of other provinces' schools of the District, as well as the Black Sea Host Lands representative when they were in Tiflis for official matters. In addition, members of the Council

could include other people who were invited at the discretion of the Administrator. They were becoming full-fledged members after their nomination was approved by the Sovereign's Vicegerent in the Caucasus region.

Gymnasiums were the highest possible form of education in the Caucasus region in the 1850s (Shevchenko et al., 2016: 367). Due to that, gymnasiums were assigned certain duties: conduct training for public service and training of applicants for admission to universities. The total number of schools was four, one school per region. Each of them had an appointed Honorary Trustee. School management relied on the School Principal who had an assistant, i.e. Inspector. Both Principal and Inspector were elected mostly from the people who had a higher education degree. The Inspector was a potential nominee for the Principal's position.

Each gymnasium of the Caucasus Educational District had 7 regular classes and one preparatory class. Regardless of this, special classes could also be established. They were preparing students for the University course.

The Caucasus Educational District gymnasiums admitted children of all individual that had unbound state. Those who wanted to be enrolled to a gymnasium, had to submit their birth and christening certificates as well as their certificate of origin. For Muslims, the birth certificate was replaced by a certificate provided by the local police officers confirming the age of the probationer student. Children of civil officials and army officers submitted statements of service and retirement orders of their fathers.

Students getting enrolled to the gymnasium preparatory class should have been not younger than 8 years old and not older than 12 years old. The 1st grade was for those from 9 to 13 years old, the 2nd grade was for children from 10 to 14 years, the 3rd grade allowed students from 11 to 15, and the 4th grade students had to be aged 12 to 16. Students of grades above the 4th were not admitted to the gymnasiums. Those who exceeded the specified age were allowed to attend the gymnasium classes as non-degree students who reported to the gymnasium administration together with the other gymnasium students. Those students who were leaving gymnasiums were allowed to be enrolled as non-degree student of the grade they had left only.

Each incoming student and non-degree student had to pay an annual fee for the gymnasium: the Stavropol gymnasium charged 5 rubles, and the rest were temporarily charging 3 rubles.

All gymnasiums were teaching the following common subjects:

1. The Orthodox Scripture teachings;
2. The Russian language;
3. Geography;
4. History;
5. Mathematics;
6. Physics;
7. Mathematical and physical geography;
8. Natural history;
9. Calligraphy;
10. Sketching and drawing.

Nevertheless, the teaching process included the regional features. Thus, the Tiflis gymnasium taught: 1. Gregorian-Armenian and Roman Catholic scripture teachings, Moslem law of Omar and Ali, and for the indigenous dweller students there were 2. The Georgian language, 3. The Tatar language and 4. The Armenian language. The Kutaisi gymnasium was teaching courses of the Roman Catholic scripture teachings, the Georgian and Turkish languages. The Stavropol gymnasium had Gregorian-Armenian scripture teachings for Armenians and Moslem law for Moslems, as well as the Tatar, Circassian and Armenian languages. The Ekaterinodar gymnasium taught Moslem law for the Cherkes students, fencing and gymnastics, military science and the Circassian language.

In addition, there were special subjects:

1) Russian jurisprudence was taught to those who were getting prepared for public service;

2) Those preparing to enter higher and specialized educational institutions had Latin and French (as required);

3) Teachers-to-be, apart from foreign languages, also had didactics and pedagogy.

Apart from the subjects mentioned above, other subjects could have been introduced: elementary agriculture, inter-discipline sciences, practical mechanics and chemistry.

Out of the local languages, the following were mandatory: Georgian and Tatar at the Tiflis gymnasium for all students of the first two grades; as for the senior grades, the students could choose one of those languages; at the Stavropol gymnasium the Tatar language was mandatory for all students and Circassian for the students educated and supported by the state* who were staying at the gymnasium boarding house, as well as for the students educated at the expense of the Caucasus Linear Cossack Host; in Kutaisi the Georgian language was mandatory for all students and Turkish had to be taken by the students supported and educated by the state; in Ekaterinodar, Circassian was mandatory for all students. The Armenian language was taught at all gymnasiums where it was supposed to be taught, but it was mandatory for Armenians only.

Teaching at gymnasiums was performed by senior and junior teachers. Their number was determined by the staffing chart. Senior teachers were teachers of: the Russian language, mathematics and physics, history, jurisprudence, as well as: (a) teachers of natural sciences, agriculture and the Latin language at the Tiflis gymnasium; (b) teachers of natural sciences and agriculture at the Ekaterinodar and Kutaisi gymnasiums; (c) teacher of Latin language at the Stavropol gymnasium.

Junior teachers were the teachers of languages and sciences. Teachers of art and preparatory classes were not considered junior teachers.

4 lessons were held daily from 8am to 2pm according to the schedule. Training course in the Caucasus Educational District gymnasiums began on the 1st of January. Annual tests were taking place from the 15th of November to the 23rd of December. Summer vacations† started from the 1st of July to the 15th of August for the Stavropol gymnasium, and from the 1st of July to the 1st of September for the Ekaterinodar and Transcaucasian gymnasiums.

Schools with boarding houses and noble pensions constituted an important part of school education. Every gymnasium had such boarding houses or noble pensions. Boarding houses and noble pensions were intended to provide free education for the children of the upper class who were unable to pay the tuition fee due to their poverty.

The number of such students was different in every gymnasium: in Tiflis there were 120 students, in Kutaisi and Ekaterinodar there were 120 students in each gymnasium, while in Stavropol they were 182. Out of these students, the following number were being educated and supported by the state: 65 students at the Tiflis pension (30 of whom were merited princes and noblemen of the Tiflis province. 20 decorated Russian officials, mainly gentlemen by birth, living or deceased in the Caucasus, and 15 children of honored upper class Moslems and Armenian meliks‡); at the Kutaisi pension there were 60 students (35 of whom were the children of princes and noblemen of the Kutaisi province, 10 children of the Mingrel princes and noblemen, 5 children from the Abkhazian§ and other tribes and 10 children of decorated Russian officials, also mainly gentlemen by birth, residing or dead on duty in the Caucasus); at the Stavropol pension there were 142 students (30 of whom were children of local Russian noblemen and officials, 65 children of honorable mountain dwellers of the Caucasian line, princes, uzdens and 47 children of the Caucasus Linear Cossack Host officers; the latter were supported by the Host's payments), and at the Ekaterinodar pension there were 35 students from children of the Circassian tribes honorable persons, 25 students educated and supported completely by the state and 35 students with partial state support out of the children of officers and officials of the Black Sea Cossack Host; the latter 60 students were supported by the host's payments. Half-state students were those who received a decreased amount, namely 50 rubles per each student; parents of these students were obliged to pay 40 rubles annually for their uniforms. The remaining vacant places in the pensions were occupied by students consisting of the children of upper class natives paying their own expenses, children of Russian officials and children of hereditary honorary citizens.

* Students educated and supported by the state – within a period from the 17th century to the first half of the 19th century this was the term for students of certain educational institutions educated and supported completely at the state's expense (compared to the students paying their own expenses).

† Vacation is a synonym for recess, i.e. time when there are no classes.

‡ Melik is a title of a reigning feudal lord.

§ Vacant places assigned to the Mingrel and Abkhazian princes and noblemen could only be occupied at the discretion of the lords of Mingrelia and Abkhazia.

Admission age to the noble pensions at the Caucasus Educational District gymnasiums was defined to be at least 9 years old and no older than 15 years, namely, one could enroll to the gymnasium preparatory class until they are 11 years old. The 1st grade was for children not older than 12, the 2nd grade was for the children not older than 13, the 3rd grade was for the children not older than 14, the 4th grade was for the children not older than 15; those who exceeded the age of 15 were excluded from the nominees list.

An important function of promoting public education in places where there were no gymnasiums was performed by the higher four-year colleges. Such colleges also had boarding houses. There was one single such college in the Caucasus region. It was located in the principal city of the province, Shemakha.

The Shemakha four-year college had a boarding house for 50 students. 25 out of them were permanently supported by the state (20 children came from the families of the Moslem upper class and 5 of them were the children of the decorated Russian officials). Other vacant places were occupied by the students paying their own expenses.

An honorary trustee was in charge of supervising the college. Honorary trustees of the higher four-year colleges were appointed from the upper or noble class. Those willing to be appointed to this title committed to contribute a certain amount to the good of the college, no less than 700 rubles.

The higher four-year college reported directly to the Colleges Directorate.

Higher four-year colleges accepted children of all classes. No fees were required from the students. No special knowledge was required to enroll in the preparatory class. Each student paying their own expenses at the Shemakha pension paid 90 rubles. Moreover, when enrolling, the 30-ruble one-time fee was payable for the possessions to be used.

The college consisted of 4 regular grades and one preparatory class. The curriculum included the following subjects:

1. The Orthodox and Gregorian-Armenian Scripture teachings, articles of faith of their religion for Muslims and reading of the Quran, 2. The Russian language, 3. Geography, 4. History, 5. Mathematics, 6. Natural history, 7. Jurisprudence, 8. The Tatar language, 9. the Armenian language for students of the Armenian origin 10. Calligraphy and technical drawing (Provisions on the Caucasus Educational District, 1853: 50).

The four-year college training course started on the 1st of January, just like at the Caucasus District gymnasiums. Vacation time was from the 1st of July to the 1st of September.

District and county schools of the Caucasus Educational District were one step down. They were in charge of the students' moral training and over the long term they trained teachers for initial and private schools.

District and county schools were managed by a full-time supervisor who was elected from among the teachers who were dedicated to their service, had impeccable conduct and knowledge. Honorary supervisors were also appointed to supervise the district and county schools, as well as the parish and private educational institutions, regardless of the full-time supervisors.

Honorary supervisors were appointed from civilian and military officials serving in the district, or from the noblemen, as well as from all persons of unbound state, known to the school administration. Those willing to be appointed to this position had to contribute a certain amount to the good of the college, no less than 500 rubles.

District and county schools of the Caucasus Educational District consisted of a preparatory class and two district-level classes; the third district-level class could have been established in case of additional financing.

Each district school had a number of teachers implied by the staffing chart. Clergy members were appointed as the Orthodox and Gregorian-Armenian catechists by the county supervisor.

District and county schools taught the following subjects:

1. Scripture teachings, i.e., prayers, a short catechism and a short sacred history;
2. The Russian language and Russian grammar;
3. A local language;
4. Arithmetic;
5. Brief geography, universal and Russian;
6. Brief history of the world, Russian and local history;

7. The initial concepts of geometry, i.e. explanation of lines, planes and objects and their essential properties, and drawing geometric objects freehand;

8. Calligraphy (Provisions on the Caucasus Educational District, 1853: 53).

Apart from the above mentioned subjects, the schools where most of the students belonged to the class of gentlemen by birth or personal nobility, also taught: 9. Forms of proceedings and judicial order with practical exercises and 10. Accounting.

Moslem students studied their faith with the school Mohammedan teacher of religion who also taught the Tatar language.

The Georgian language was considered the local language in the Tiflis province. Local language of other districts of the Transcaucasian region and the Stavropol province was Tatar.

Learning the local language was compulsory for all students of the district schools; the Armenian language, on the opposite, was taught where it was supposed to be taught, to the Armenians only.

The school course was biennial for each of the two higher grades; however, there were one-year courses for each grade upon opening of the 3rd district grade.

School started on the 1st of January. Vacation time depended on the specific regional peculiarities: in Elisavetpol, Erivan and Nakhichevan vacations lasted from the 15th of June to the 15th of September. As for the Stavropol Directorate colleges, vacation time was from the 1st of July to the 15th of August. The rest of the district were on vacation from the 1st of July to the 1st of September.

No fee was charged for the district and county schooling. No basic knowledge was required to be enrolled in the preparatory class.

The Poltavskaya and Umansky county schools had to have pensions for 20 students each, who were recruited from the children of the Black Sea Cossack Army officers. Orphans and unprivileged children constituted the majority of the pensions' students.

The county school pension admission age was limited to no younger than 8 and no older than 13 years.

The Poltavskaya county school, on top of the military students, had to accept 10 pensioners from Circassian tribes. Their tuition was paid for by the state. Apart from that, if there was room, pensions could accept students from the field officers children paying their own expenses at the rate of 90 rubles per year.

As for initial schools, these were being established as and when necessary with the permission of the Sovereign's Vicegeerent in the Caucasus region. These schools, located on the lands of the Black Sea Army were supported at the expense of the military contributions; in other areas of the Caucasus and Transcaucasian regions they were supported by the communities for which these schools were established. An exception was made for the Racha district of the Kutaisi province, where the state supported schools in the following cities: Kutaisi, Redut-Kale, Ozurgeti, Dusheti, Kuba, Lenkoran, Ordubad, Novo-Bayazet and the village of Tionet of the Tushino-Pshavo-Khevsursky county. Students of the latter school, up to 25 in number, children of the Tushin, Pshav and Khevsur elders, were supported annually with financial resources and food supplies.

Initial schools accepted male children of all social classes no younger than 8 years old. It was strictly prohibited to have children of different genders at the same school.

Those entering initial schools were required neither tuition fees nor basic knowledge.

Initial schools were divided into two types: one-grade and two-grade schools. Two-grade schools allowed establishing of the special sciences courses.

The curriculum included the following subjects:

1) Scripture teachings of the religion practiced by the residents of the settlement; 2) Russian writing and reading, practical knowledge of the Russian everyday language; 3) writing and reading in a local language; 4) four main arithmetic operations (Provisions On the Caucasus Educational District, 1853: 59). These subjects were fixed and later on they were included into the Provisions On Public Schools dated May 25, 1874, with the only addition, that apart from these subjects liturgical chanting could be introduced where it was feasible (Izvestiya Dumy News Of The Duma, 1874: 1234).

The two-grade initial schools also had the following subjects added: brief catechism and brief scripture history, brief Russian grammar. As for arithmetic, there were common fractions and operations with them. Students were also taught calligraphy.

Special courses of the two-grade schools taught: common knowledge of agriculture and horticulture where the population consisted of agricultural workers, and keeping the merchant books envisaged by law where the population was involved in trade; moreover, it was allowed to teach a language of the community for which this school was established.

Teaching Scripture and the local language at the initial schools provided that the population was Christian, was carried out by the local parish priests, while the Moslem population was taught by the local mullahs. Both priests and mullahs were to be approved by the county trustee upon the school principal's recommendation.

The initial school teachers were elected mainly from persons who had completed a gymnasium course, or at least a course at district schools. Military residents were preferably appointed to these positions in the lands of the Black Sea Army.

Time during which the studying process was supposed to take place had been determined with regard to climatic and other regional factors. The same referred to the vacation time. School year began with on the 1st of January.

Supervision over the schools located within the Black Sea Cossack Army lands was confided to a supervisor out of retired Army officers; other initial schools of the Caucasus Educational District had the Russian language teachers as supervisors.

An honored guardian was appointed to every school to render assistance to the school administration. This staffing had to be approved by the Sovereign's Vicegerent in the Caucasus region.

Financial resources were allocated to support the Orthodox church schools in several areas of the district. This referred to the existing and newly established schools in Ossetia, Samurzakan and Svanetia. It is important to note that all such schools, which had been allocated public funds, were under the supervision of the Schools Board of Directors.

Schools that existed at the roman Catholic churches in the cities of the Caucasus and Transcaucasian regions were considered to belong to the initial schools. They taught all subjects assigned to these schools. These schools were reporting to the gymnasium principals if there was a gymnasium in the cities where they were established. In other cities they were reporting to the local in-house supervisors; the closest supervision over these schools was confided to a priest of that church at which this school was established.

Teachers of these schools were being elected school principals out of those students who completed the gymnasium sciences course and belonged to the Roman Catholic religion. They were getting salaries of 200 rubles per year from the temporalities or from the congregation's contribution.

A few words must be said about schools at mosques. Such schools enjoyed special rules. The school principals could only request, through the local authorities, annual information on the number of such schools, names of the mullahs teaching there and the number of students. The mosque schools could be transferred into a category of initial schools with the permission of the Sovereign's Vicegerent in the Caucasus region upon request of the residents and with financial means provided by them.

Completing the review of the Caucasus public education system, private educational and training institutions should be mentioned. Private educational and training institutions established within the Caucasus Educational District for male children were of two types: 1) private pensions[*] and 2) private pensions at the state educational establishments[†]. Private educational institutions for female children in the Caucasus Educational District could only be of the first kind.

Opening of private pensions was allowed in accordance with the existing rules. Private pensions at the state schools were allowed to be kept by the people of high moral standing. District school teachers were allowed to keep private pensions at the state schools henceforth until a special order.

[*] Private pensions were institutions where students either resided or were attending them to receive education in those academic subjects that were approved by the program.

[†] Students resided in the pensions under the supervision of boarding landlords and room guards. The latter accompanied them to the classes of those schools where they were studying.

Teachers at private pensions had to be those persons who had the right to teach. Pension keepers had to inform their superiors in charge of the pension supervision on the teachers' appointment and replacement every time.

Among private schools there were initial schools that were established by private individuals for the children of both genders in the cities and villages to teach spelling, local languages and prayers of their faith. Children of different genders were not allowed to attend the same school, as in public schools.

All private educational institutions, as well as schools were under direct supervision of the school principals in the cities of Tiflis, Kutaisi, Stavropol and Ekaterinodar. In-house supervisors had this duty in other locations.

In order to cover as many students as possible, the Caucasus Educational District Administration was training a certain number of home teachers out of the students educated and supported by the state who completed a course of special gymnasium classes. Home teachers graduating from special gymnasium classes were obliged to remain in this position for at least 6 years. Throughout this whole period of time, home teachers educated in the special classes were under special patronage of the Caucasus Educational District Administration, which was watching over them them guided by the rules, adopted by the administration of the institutions under the supreme patronage of Her Majesty the Empress, when admitting impoverished female students, who completed their education in these institutions, to positions at private homes (Provisions On the Caucasus Educational District, 1853: 67).

5. Conclusion

In summarizing, it is important to note that unification and regulation of educational process was taking place in the Caucasus region in the 1850s. The time of chaotic operations at gymnasiums and secondary schools ended, the population of the region was increasingly understanding the benefits of education. As the result, Caucasian schools were becoming increasingly similar to their counterparts in the inland areas of the Russian Empire. Nevertheless, evolution of the public education system in the Caucasus was taking place in view of the ongoing Caucasian War in the region. That is why mosque schools enjoyed a practically autonomous status, since the Russian Administration tried not to provoke the local Muslim population. In addition, the Caucasus region didn't have any mixed schools. This was also a regional feature of this area.

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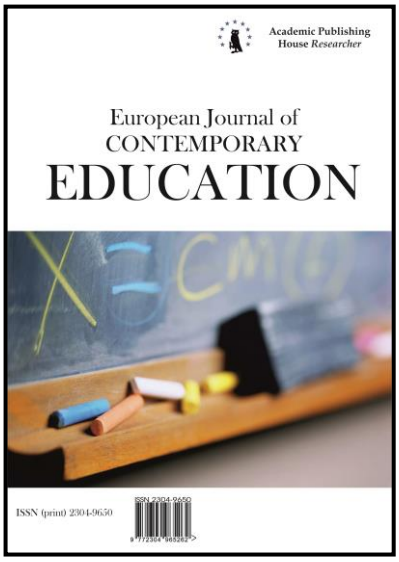
Published in the Slovak Republic
European Journal of Contemporary Education
E-ISSN 2305-6746
2018, 7(3): 608-614
DOI: 10.13187/ejced.2018.3.608
www.ejournal1.com



Highland Schools in the Caucasus: Historical Background

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Abstract

The article explores the history of the highland schools (Gorskaya shkola) in the Caucasus that covers the period from the 1850s to the 1860s. Established in 1859 and originally planned to function as a pilot project for four years, they proved to be effective, so the experiment continued. This paper also examines the legal status of highland schools.

The desk research was focused on facts derived from official archives of the Ministry of Education published in the 'Journal of Ministry of Education'. Such sources included legal documents, extracts from reports of the Minister of Education and the Trustee of the Caucasus Education District, as well as local findings on operation of the then established schools.

The research methodology is based on principles of historicism, objectivity and systematism that are commonly used in historiography. The study involved the problem-based chronological method to scrutinize certain facts in the history of highland schools' development in the Caucasus, and disclose the highlanders' interest in such institutions which prompted further establishment of other highland schools in the region.

In conclusion, it is important to state that the network of highland schools in the Caucasus allowed not only to satisfy educational needs of children residing in the highland communities, but also to co-educate them with children of the Russian Empire commissioners. Graduates of such schools maintained a wider range of social relationships (through religion, consecrated friendship, comradeship) that helped them to adapt easier to the rapidly changing world and to the rapidly changing situation in the Caucasus.

Keywords: highland school, the Caucasus, the 1850-1860s, the Russian Empire, 'Journal of Ministry of Education'.

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1. Introduction

In 1859, when the Caucasian War waging in the eastern part of the Caucasus was about to cease, the Viceroy of the Caucasus, Adjutant General, Duke A.I. Baryatinsky submitted to Emperor Alexander II a concept of establishing special schools with the purpose to educate children of highland indigenous tribes of the Caucasus (Trekhbratova, 2015: 60).

On October 20, 1859, the Russian Emperor approved the draft of the Statute of Highland Schools. An important fact was that Imam Shamil was captured in the Caucasus in the very same year. The Russian administration was proactive at that time and did its best to cool down and stabilize the society by creating a network of highland schools. In accordance with the Statute, these schools were launched as a pilot project that would last for four years. One of the main reasons for establishing these schools was the fact, that in some territories controlled by the Russian military troops for several decades there had not been a single public school for children (neither for civil commissioners, nor for indigenous population). Such territories were: Sukhum, Vladikavkaz, Nalchik, Temir-khan-Shur, Ust-Laba and the Groznaya fortress.

2. Materials and Methods

Our desk research involved the study of documents, derived from official archives of the Ministry of Education, that had been published in the 'Journal of Ministry of Education'. Such materials include legal documents, extracts from individual reports of the Minister of Education and the Trustee of the Caucasus Education District, as well as local findings on operation of the established schools.

The research methodology is based on principles of historicism, objectivity and systematism that are commonly used in historiography. The study involved the problem-based chronological method to scrutinize certain facts in the history of highland schools' development in the Caucasus, and disclose the highlanders' interest in such institutions which prompted further establishment of other highland schools in the region.

3. Discussion

The first written evidence of establishment of highland schools in the Caucasus refers to the period immediately following the formal approval of the draft Statute of Highland Schools, i.e. the pre-revolutionary time. For instance, a report on the establishment of a highland school in Zakataly was published in 1863 (Shkola dlya gortsev, 1863), the school in Sukhum was referred to quite often (Izvlechenie iz otcheta, 1866; Otkrytie zhenskoi shkoly, 1871), some other schools were also mentioned.

A remarkably big amount of publications on highland schools appeared in the modern period, as this topic attracted researchers from national territories in the North and West Caucasus. A number of recent articles discuss Russia's politics in the Caucasus, for example, papers by T.A. Bekoeva (Bekoeva, 2009), V.A. Sturba (Shturba, 2010) and S.A. Trekhbratova (Trekhbratova, 2015). The topic of education development for Muslims was the scientific interest of such researchers as M.F. Titorenko, O.G. Shkileva (Titorenko, Shkileva, 2008) and R.A. Khachidogov (Khachidogov, 2015). Articles devoted to the history of regional schools can be considered a specific type of papers. For example, the highlanders' schooling in Osetia was studied by E.I. Kobakhidze, N.A. Ladonina (Kobakhidze, Ladonina, 2015; Ladonina, 2015), in Dagestan – by D.Z. Ataeva and K.I. Khadzhilaev (Ataeva, 2009; Khadzhialiev, 2011), in Grozny and Nalchik – by T.A. Bekoeva, A.Z. Magamedova, A.G. Kudzaeva (Bekoeva, Magamedova, 2016; Kudzaeva, 2016).

4. Results

The Statute consisted of five Chapters: 1. Number, Aim and Division of Schools; 2. Regional Schools; 3. Primary Schools; 4. Boarding Facilities at Highland Schools; 5. Guidelines on Administration of Highland Schools and Their Boarding Facilities.

The aim of establishment of highland schools was to promote the idea of civic consciousness and education among peaceful highlanders, as well as to provide families of officers and civil commissioners in the Caucasus with education opportunities for their children. The highland schools were founded as district-based first-level educational institutions.

The schools were established in the following locations: a) regional schools: in Vladikavkaz, Nalchik, Temir-khan-Shur; b) primary schools: in Ust-Lab, the Groznaya fortress, and Sukhum (Trekhbratova, 2015: 61).

There were four forms in regional schools; including a pre-school program.

Regional schools, like other district and regional educational institutions that were subordinate to the Caucasus Education District, were administrated by full time inspectors appointed by the Commander in Chief of the Caucasus Army and the Viceroy of the Caucasus on request from the Trustee of the region. The inspectors were recruited from amongst the teachers who demonstrated high-level pedagogical skills.

The full-time inspectors were selected mainly from the list of candidates who had obtained a diploma from a university or who had completed a full course at a Pedagogy department of the Stavropol Gymnasium.

Apart from a full-time inspector, personnel of such schools consisted of: teachers of Orthodox religion and Islam, three teachers of sciences and one teacher of a pre-school course; the former two teachers came from the clergy, while teachers of sciences and the pre-school course were graduates of institutions of higher education.

Regional schools were originally founded for indigenous highlanders and for children of Russian officers and public civil commissioners; however, they could also enroll boys coming from other free social classes, irrespective of their religion.

The following subjects were taught at regional schools:

a) Orthodox Religion including praying scripts, a summary of the Manual for catechizing, a short history of religion, as well as the dogmas of Orthodox church service - for children adhering to the Orthodox church;

b) Dogmas of Islam – for Muslim children;

c) The Russian Language and Russian Grammar with practical exercises;

d) Introduction to the World and Russian Geography; the Russian geography covered some statistical information about the national and the Caucasus administrative order;

e) Introduction to the World and Russian History;

f) Arithmetic and Algebra;

g) Introduction to Geometry, including basic concepts of lines, planes and objects, together with their main characteristics, as well as the creation of geometric shapes;

h) Calligraphy and Drawing (Ob uchrezhdenii, 1859: 26; Trekhbratova, 2015: 61).

All these subjects were divided among all teachers, to guarantee equal workload.

Each course at regional schools was to last for one year, as opposed to the pre-school course that could last for two years or longer.

The academic year began on August 15. The summer vacation was scheduled from July 1 to August 15.

Those people wishing to attend the school on a part time basis, had to submit a special application to the full time inspector. The tuition fee for this category of pupils was 5 rubles per year. The Teachers Council and the local Commander in Chief were the only authorities that could allow people in need to attend school free of charge. All the funds collected from pupils were spent as follows: one half was used to pay the teachers' salaries; the other half was divided into two smaller parts. One of them was used to supply under-privileged pupils with textbooks and outfit, the other one was used to improve the content of teaching materials as well as to cover other expenses of the institution.

Graduates of regional schools enjoyed the same rights as graduates of district schools within the Caucasus Education District.

The students who had demonstrated good academic achievements did not have to take any exams to get promoted to the fourth form, if they wanted to be on a state service afterwards.

The full time and part time students who were the first ones to have successfully passed the term exam in their respective classes, could be admitted as boarders at public expense.

The primary school consisted of three forms, including one pre-school course. They were administered by inspectors who were appointed by the Trustee of Caucasus Education District and had obtained a diploma from a university or completed a course offered by the Pedagogy department of the Stavropol Gymnasium.

Apart from an inspector, the personnel of such schools consisted of two teachers of sciences, one teacher of Orthodox religion and one teacher of Islam.

Not only children of indigenous highlanders, military men and public civil commissioners were allowed to study at such schools, but also boys coming from other social classes could study there, regardless of their religious views.

The program of primary schools featured the following subjects:

a) Orthodox Religion, including praying scripts, a short history of religion, a short version of the Creed as well as praying scripts stated in the 'Basic Elements of Orthodox Faith' textbook;
b) Dogmas of Islam;
c) The Russian Language, including reading exercises, dictations, the structure of speech;
d) Counting and Introduction to Arithmetic;
e) Basic Characteristics of the Earth, and an Overview of Russian Geography;
f) Calligraphy.

The tuition fee at primary schools was lower than that of regional schools and amounted to 3 rubles per year. Poor people could be exempted from paying such fees on the decision of the Teachers Council and the local Commander in Chief.

The pupils who had demonstrated outstanding academic performance were accepted to the second form of district schools and gymnasiums within the Caucasus Education District without any exams.

No uniform was introduced for part time students of highland regional and primary schools; however, the boarders of such schools who displayed academic achievements and good behavior were granted a privilege to wear a just-au-corps.

Boarding facilities were arranged next to highland schools to assist parents in upbringing their children, as well as to better inform the young highlanders about moral values. These moral rules would develop in children's minds a sense of dignity, duty, hard work and order, and get them prepared for the civic life that was the overall aim of the whole educational process.

The boarding schools located in various geographical areas had different numbers of pupils: in Vladikavkaz – 120 people; in Nalchik – 65 people; in Temir-khan-Shurinsk – 65 people; in Ust-Lab – 65 people; in Grozny – 65 people; in Sukhum-Kal – 40 people.

There were always some boarders that were educated at the expense of the state. In Valdikavkaz there were 80 such boarders: 50 children from the most outstanding and prominent families of the Osetia military district and 30 children of Russian military men and public civil commissioners. In Nalchik, there were 25 boarders: 10 children of dukes and noblemen of the Kabarda region and 15 children of Russian military men and public civil commissioners. In Temir-khan-Shirinsk, there were 40 boarders: 25 highlanders' children from honored families of Northern and Southern Dagestan and 15 children of Russian public civil commissioners. In Ust-Lab, there were 40 boarders: 25 children from tribes inhabiting the left bank of the Kuban River and 15 children of Russian public civil commissioners. In Grozny, there were 40 boarders: 25 children from the honored Chechen and Kumyk families and 15 children of Russian public civil commissioners. In Sukhum-Kal, there were 20 boarders: 15 children of the Abkhaz, Tsebelda and Jiget families and 5 children of Russian public civil commissioners (Ob uchrezhdenii, 1859: 30).

The remaining places at schools were shared among: a) boarders who studied at the expense of collective funds (like at the Nalchik school that saw a similar funding pattern for 25 children of dukes and noblemen of the Kabarda region); b) boarders who studied at the expense of funds controlled by the Viceroy of the Caucasus; and c) boarders who paid for studies on their own (termed as 'svoekoshtnye').

The annual fee for accommodation at a boarding facility was 80 rubles.

All students of boarding schools wore a regular dark-green forage cap with a red band as well as a regular dark-green just au corps with a dark-green collar made of woven felt and decorated with red straps and polished copper buttons. In winter, the boarders were dressed in a dark-green coat that had a similar style as a coat of any regular citizen.

The age of a child wishing to be accepted to school and financed by the state (termed as 'kazennokoshtnye') had to vary between 9 and 15. Specifically, the age limit for a pre-school course was 13 years old, for a first form of regional schools – 14 years old, and for a second form – 15 years old. All children who did not satisfy this age requirement could not be financed by the state.

Every boarder could study in the same form for no more than two years; however, the children who had a nationality other than Russian could remain on a pre-school course for up to three years. The children who at the end of their study programs did not have enough knowledge to move to a higher form, were expelled from school, however, they still had a right to attend classes as part time students.

After the end of the course, the boarders were returned to their parents; the children who performed well throughout the years could be recommended by the military commander to enter a gymnasium and be granted a public subsidy. For this reason, the inspector of every school reported to the regional commander on the excellent performance of students who managed to reach the highest level. They would then be considered as prospective candidates to fill some state positions offered to the students of the Stavropol Gymnasium.

In every boarding school there was a fixed number of non-commissioned officers and common soldiers. Two or three non-commissioned officers had a task to supervise students according to a rotating schedule. While on duty, the officers were at full discretion of the room inspector.

Neither non-commissioned officers nor room inspectors had a right to punish students themselves. The inspector could only make a reprimand or deprive a student of his free time; all other types of punishment could be executed only by the school inspector or in some cases only by the Teachers Councils.

According to the school Statute, the boarding conditions for the students needed to be satisfactory, but not luxurious. The main requirement for food was its good quality; the main requirement for clothes was a smart outlook.

To facilitate the administration of schools, schools were divided into multiple directorates within the Caucasus Education District. The regional schools in Vladikavkaz, Nalchik and Temir-khan-Shur as well as the primary school in Grozny were under the control of the Stavropol Governorate; the primary schools in Ust-Lab formed part of the Chernomorskaya Governorate; the primary schools in Sukhum-Kal were supervised by the Kutais Governorate.

While being directly managed by respective school principals, these institutions were also under the control of the local military administration and its military district commander, in particular. Significantly, the military district commander enjoyed all the rights of the school's trustees. When the commander checked the facilities of his supervised school and detected some defects or malfunctions, he had to immediately inform the school principal about his remarks.

The budget of primary schools differed across various institutions depending on the number of students. For example, the schools in Ust-Lab and Grozny had 7 teachers, including administrative personnel, and 40 students. The total budget of one school in that case was 5,406 rubles per year. However, while the number of teachers and administrative personnel was the same but the number of registered students was 20, the budget of the school in Sukhum was 3,702 rubles (Ob uchrezhdenii, 1859: 38-40).

As for the regional schools, their budget was much higher than that of the primary schools (see Table 1).

Table 1. Highland schools (personnel and budget)

School	Number of teachers and administrative personnel	Number of students	Total budget (in rubles)
Primary schools			
Ust-Lab	7	40	5406.95
Grozny	7	40	5406.95
Sukhum-Kal	7	20	3702.70
Regional schools			
Temir-khan-Shur	8	40	6272.70
Nalchik	8	25	5306.95
Vladikavkaz	10	80	9793.90
Total			35890.15

Almost all new schools faced some challenges. The local population was skeptical about sending their children to such schools as they did not fully understand the benefits that education offered in general. To solve this problem, the Russian administration in the Caucasus did its utmost to make it their priority to promote people to a higher position if they had completed a program at one of educational institutions.

New schools were launched in accordance with the approved schedule. The regional school in Temir-khan-Shurin opened in 1861. A boarding house was constructed next to the school that could accommodate the total number of 65 students: 40 children were financed by the state, 25 children came from the honored families of Northern and Southern Dagestan as well as families of Russian public civil commissioners (Khadzhialiev, 2011: 162).

By 1864, the number of teachers at the school in Sukhum was 4, while the number of students was 53. In 1865, the number of teachers remained the same, but the number of students decreased to 47 (Izvlechenie iz otcheta, 1866: 350). The establishment of the first school in Abkhazia led to the creation in 1871 of the first women's boarding school (Otkrytie zhenskoi shkoly, 1871: 773).

The creation of highland schools proved to be a successful project that was extended over a longer period. As a result, a boarding school in Zakataly was opened in 1862. At first, the population did not trust that institution, and only 5 students were admitted to the program, while there were 25 vacancies at the boarding school. However, four months later the situation changed, and all available places were occupied while the administration received hundreds of applications (Shkola dlya gortsev, 1863: 114).

5. Conclusion

In conclusion, it is important to state that the system of highland schools, that was formed in the Caucasus, allowed not only to satisfy the educational needs of the children who lived in the highland region but also to co-educate them together with children of Russian public civil commissioners. Graduates of such schools maintained a wider network of cultural relationships (through religion, consecrated friendship, comradeship) that helped them to adapt easier to the rapidly changing world and to the rapidly changing situation in the Caucasus.

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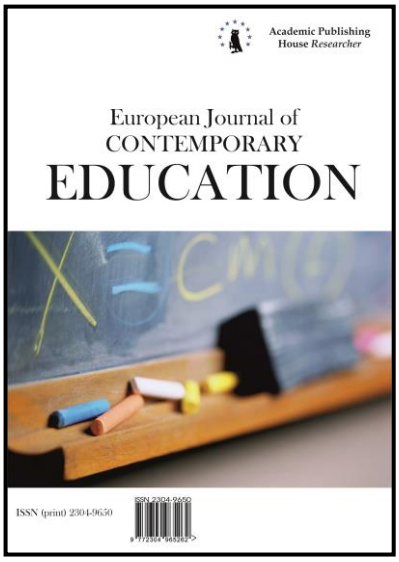
Published in the Slovak Republic
European Journal of Contemporary Education
E-ISSN 2305-6746
2018, 7(3): 615-622
DOI: 10.13187/ejced.2018.3.615
www.ejournal1.com



Student Clubs in Siberia at the beginning of the XX century (Adapted from Materials of the Journal «Siberian Student»: 1914–1916)

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Abstract

This paper is devoted to the research of activity features of the student clubs existing in the territory of Tomsk at the beginning of the last century, conducted on the basis of materials of sketches and articles published in the popular periodical of the beginning of the 20th century – «the Siberian Student». Student clubs were often considered in terms of the following thematic blocks:

- a parenthesis with the indication of concrete date or year of club establishment;
- the short description of its activity from indications of events, significant for it, and important dates of functioning up to date of the publication of this or that material;
- the description of achievements, results of the youth organization activity, a positive role in the creative development and association of students;
- emphasis of attention of reader's audience on daily and (or) most current and serious problems which concrete clubs or student clubs in general faced;
- the recommendations of authors about the solution of major problems in the organization and activity of the relevant student's organizations.

Keywords: Siberia, «The Siberian Student», higher educational institutions, Tomsk University, Tomsk institute of technology, students, youth, student clubs.

1. Introduction

At the beginning of the 20th century there were many clubs and unions in Tomsk – the city where the first higher educational institutions of Siberia have been established. An essential part of

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them has been established at higher education institutions, and some – at the public and charitable organizations.

The magazine «Siberian Student» was at that time a certain "voicer" of students' thoughts and moods. It was regularly mentioned about the most popular clubs and youth organizations existing in the territory of Siberia in this periodic publication. According to the number of thematic publications, the most popular among student's youth at the beginning of the XX century were: the engineering club, a photography club, an aero club created at the Tomsk institute of technology; a club of the war victims support, the Siberian and economic clubs organized at the Tomsk University.

2. Materials and methods

The research is based on the analysis of materials published at the beginning of the XX century in the Siberian print media. The reports, sketches and articles devoted to the activity of student clubs and unions and published in the popular youth magazine - "The Siberian student" issued from 1914 to 1916 were mainly discussed.

The research was conducted by means of a method of the content analysis by means of which the reports, sketches and articles devoted to the student clubs activity and published on pages of the Siberian press at the beginning of the XX century were studied; the historical and system approach which has allowed to reveal interrelations of various historical events and facts and also to systematize the established data; a narrative method by means of which the elicited facts and events are stated in a consecutive order.

3. Discussion

The activity description of Siberian student clubs functioning at the beginning of the XX century was represented in various historical sources, including the documents of the State archive of the Tomsk region (SATR) and also in the magazine «Siberian Student» published regularly from 1914 to 1916 (Belov, 1914; In a club..., 1915; Zinstein, 1914; Club..., 1914; Mirov, 1915; Petrovich, 1915; Student's..., 1914; Economic..., 1914; Enge, 1914).

These sources contain data on dates of student clubs' organization, their main activities with the description of significant events, achievements and results of work and also major problems which the management and members of given youth organizations faced.

While working on this article the authors used materials of some other periodicals of the studied period in which separate events in activity of clubs were considered, or announcements on behalf of their members were published: "The Siberian life", "The Omsk bulletin", "Morning of Siberia", etc. (Siberian..., 1908; Morning..., 1916; Omsk..., 1912).

Besides historical sources authors studied the scientific works which were published in the Soviet, Post-Soviet and modern periods devoted to the questions connected with the activity of the first Siberian higher education institutions at a turn of before last and last centuries. However in works of this type the activity of student clubs if it was mentioned, then it was done briefly – among the numerous other aspects connected with life and study of the Siberian student's youth at that time (Zaychenko, 1960; History..., 1975; Professors..., 1996; Lozovsky, 1971; Kuzminova, 2005; Vermeer, Van Der Ven, 2003; Dudgeon, 1982; Tolmacheva et al., 2017; Ustinova, Skifskaya, 2017).

4. Results

The Siberian club was rendered as one of the most popular youth organizations functioning in the territory of Tomsk at the beginning of the last century. The reports, articles and notes devoted to the activity of this student's organization were regularly published on pages of Tomsk periodicals (Mirov, 1915: 63-66; Zinstein, 1914: 57-66).

The complex study of Siberia in all of its aspects, including historical, ethnographic, economic and cultural features was the key purpose of the Siberian club. As I. Zinstein paid attention in his report: "The urgent need of association of Siberian students for scientific studying of Siberia in all directions, scientific clarification of real needs of the country and ways of their implementation has become actual and the most important" (Zinstein, 1914: 59).

It is specified in the article that the Siberian studentship organized the "Siberian Club of Tomsk Students" at the beginning of 1907 (the contracted and often used name – the Siberian club). However this youth organization has found the legal status only by the end of 1908.

At the same time initially opening of numerous sections which would specialize in the solution of versatile questions was planned by the club activity, including: rogue classes, colonial policy, a labor question, national education, ethnographic, geographical, archaeological, historical, financial, commerce and industry, agricultural, territorial, classes of the Siberian bibliography, municipal economy and management, etc. (Zinstein, 1914: 61).

However not all plans managed to be realized. As it was noted in one of issues of "The Siberian student", only a few classes were actually organized among which: research into the topic of unemployment in Siberia classes and also studying of economic life of Siberia (1909) under the leadership of Professor M.I. Bogolepova. Since 1910 two more sections under the leadership of professor N.Ya. Novombergsky have been created: regarding territorial and resettlement problems (Zinstein, 1914: 61-62).

Further in I. Zinstein's article there was a list of numerous difficulties and problems which this organization faced. Authors would mention some of such statements:

- "1911 comes – when all student's organizations have stopped their activity, thanks to the known ministerial circular, the serious crisis appears also in the club life ";
- "The Siberian club was directed only by few companions supporting its existence";
- "Although much of efforts ... was not carried out, the first steps are taken, ... our duty is to continue activity", etc.

The significance of the Siberian club occupation, despite all difficulties and problems was repeatedly emphasized throughout of all article written by I. Zinshtein, the strong patriotic epigraph which has ended the narration serving long time as the motto of the popular periodical at the beginning of the XIX century of "National reports" based by the famous diplomat, the traveler and the writer – P.P. Svinyin:

«God appeals to love the Homeland!

And to appreciate the Homeland is the nobility, the admirableness and duty" (Svinyin, 1904: 218-219; Zinstein, 1914: 66).

One more popular club, organized at the Tomsk University, was possible to be recognized as the economic club. It was founded in 1909. Priority tasks of this student's organization are mentioned below:

- self-education by means of a research of political and economic problems;
- the study of the theory of political economy in historical aspect considering features of economic life development.

The main activities of a club were: making reports, thematic papers, its reading and discussion at special meetings.

As appears from materials of the Tomsk student press at the beginning of the 20th century, the head of this organization was the professor M.N. Sobolev from the moment of an economic club organization up to 1911 (Economic..., 1914: 73-74; Petrovich, 1915: 59-62).

It is necessary to notice that in 1911 the club has temporarily finished its activity, and in 1914 it restored its activity. On March 15, 1914 the administrative meeting was held and the board of members an economic club was elected circle. Since this period the board members of this organization became: M.A. Barushkin, N.I. Samoylovich, V.N. Lavrov, N.S. Yurtsovsky and V.V. Kalugin. As candidates for board members have been claimed: A.I. Bakin and S.M. Polushkin. Since the same period Professor P.I. Lyashchenko became the leader of the club. 43 members of an economic club have been registered in 1914 (Economic..., 1914: 73-74; Petrovich, 1915: 59-62).

It should be added that in September, 1914 the charter of one more youth organization – a club of the war victims' support was accepted at the Tomsk University. The special committee of a club was conditionally divided into several sections, responsible for the separate fields of work: section on project finance sourcing and on "intercourse" (that is, to building relations) with other organizations; on inspection and studying of financial situation of families of wounded and reserved; on supporting the necessary help to displaced persons; pedagogical; medical and judicial sections.

The club throughout all time of the existence was engaged in active charity, supported soldiers and their families (Pivovarova, Zubareva, 2017). For example, in "The Siberian student" it was reported that the section on project finance sourcing has organized a charitable performance in cinema "New" and cleared a profit of 258 rubles 63 kopeks. Proceeds have been allocated to the

categories of citizens mentioned above. Also other numerous charity events have been held and widely covered in the Siberian print media (In a club..., 1915: 57-60).

The technical club opened in 1909 at the Tomsk institute of technology was not less popular student's organization operating in the territory of Tomsk at the beginning of the 20th century. As key tasks of the youth organization have been designated:

- self-education and self-development in technical field of knowledge;
- empowerment of more detailed and broad studying of engineering sciences;
- training of students to individual research work;
- financial support to extremely needing members of a technical club;
- the development of amateur activity of students in the technical sphere of knowledge (Enge, 1914: 67).

Reading reports, papers and messages; demonstration of the equipment, devices and experiences; organization and holding trips and excursions; the commercial activity directed to increase financial means of the club; the organization and arrangement of reading room, library, museum and other institutions in compliance with the purposes of a technical club; provision of summer practice to members of the organization; the arrangement of competitions with appointment and issue bonuses to the best of members of a club; edition of the best student's works and also other original and translated works of technical orientation; sale of books and guides, scientific literature in the field of technical science; holding exhibitions of drawings and projects; organization of the plants inspection, etc were distinguished as the main directions of activity.

The analysis of the print media of the beginning of the XX century has allowed authors to reveal key stages and important dates of functioning of this student's organization (Table 1).

Table 1. Key stages and events in activity of the student technical club created at the Tomsk institute of technology (Enge, 1914: 69-70).

The main stages	Event in the club activity
1909	Establishment
	Confirmation of a foundation, definition of main objectives and tasks
1910	The organization of engineering section
	Adoption of the new charter
1911 to 1.09.1912	Formation of archeological section
	Allocation of chemical section
	Holding of a big summer excursion
	Opening of a shop by club's members
From 1.09.1912 to 1.01.1914	Holding a big summer excursion
	Organization and holding of the exhibition
	Change of the charter
	Commercial activity expansion

Besides the description of key stages of activity, the features characterising the current situation and achievements of a student technical club from the moment of its establishment up to date of the publication of the corresponding material in the magazine (Table 2) were also published in "The Siberian student".

Table 2. Some indicators of the state, activities and achievements of the students' technical club, established at the Tomsk Technological Institute in the period from 1909 to 1914 (Enge, 1914: 69-70).

No.	Period	Number of club members	Number of reports	Number of books in the library	Number of magazines in the reading room	Cash cycle of the club	Expences for the library
1.	1909	122	12	111	15	157 rubles 55 kopecks	26 rubles 71 kopecks
2.	1910	116	5	199	24	294 rubles 49 kopecks	74 rubles 31 kopecks
3.	from 1911 to 1.09.1912	202	13	330	31	6578 rubles 7 kopecks	96 rubles 12 kopecks
4.	from 1.09.1912 to 1.01.1914	173	18	680	45	14989 rubles 89 kopecks	229 rubles 42 kopecks

Based on the indicators shown in Table 2, the activities of the students' technical club as a whole can be considered as successful, despite the occasional problems of material equipment and financing. The number of books in the club library for this period increased more than 6 times, and the number of magazines in the reading room tripled. Cash cycle of funds grew significantly: from 157 rubles 55 kopecks up to 14,989 rubles 89 kopecks, that is, more than 96 times.

In 1909, at the Tomsk Technological Institute, a photo club was created, which aroused a special interest among students. In one of the articles published in the "Siberian student", significant peaks of the development and functioning of the photo club were considered through the prism of its material support. The publication indicated the following significant dates for the development of the club:

- from 1909 to 1910 it was the placement and functioning of a photo club in the basement of the chemical building of the Tomsk Technological Institute, where, with the permission and support of the university management, a special dark room and a darkening laboratory with the purpose of working with photographic paper were organized and equipped by the members of the club;
- 1911 the photo club got a separate room on the first floor of the chemical building of the Tomsk Technological Institute;
- by 1914, there were already at the disposal of the club: a special room intended for working with photographic paper, a dark room, two dark laboratories, a separate light laboratory, a room for drying fingerprints, etc. Laboratories of the club were already equipped with gas, water, electricity, the necessary set of "accessories for photographic research" and apparatus (Belov, 1914: 69-70).

The following key objectives and tasks of the photo club were distinguished:

- the promotion of the study of Siberia through photographic documentation of its life;
- obtaining the theoretical knowledge and practical skills in the photographic work;
- filling gaps in teaching the photography at the Tomsk Technological Institute;
- facilitating the club members the "earning a living" by performing the private orders on the basis of acquired knowledge and skills (including reproductions and enlargement of photo images) (Belov, 1914: 77).

There were the main activities and those implemented on the club basis:

- Reading and listening to the lectures and speeches of specialists in photographic work;
- (Participation in practical experiments in specially designated laboratories (toning of photographs, enlargement of images, classes on reproduction, etc.);
- Holding of exhibitions of photographic works;
- Participation in photographic competitions (for example, a contest entitled "The Life of the Institute" with three established awards in nominations: the best photographing, originality, vitality of the plotting);
- Conducting the general administrative meetings;

- Organization of scientific meetings and so-called "comradely conversations" (within the framework of these events, abstracts and reports on photographic subjects were read, camera models, photographic processes, and the results of photographic activity were demonstrated);
- Fulfillment of private orders for photographic work;
- The organization of work and the use of its own library, which contained a large information base on the topics under study, including also periodicals such as "Bulletin of Photography", "Bulletin of the Odessa Photographic Society", "Photographic Sheet", "Photographic News" and etc. among other publications.

By the time of publication of the article published in the "Siberian student" in 1914, the photo club consisted of 64 members, three of which were honorary members of the mentioned organization: Professor Ya.I. Mikhaylenko, R.T. Tyumentsev and B.V. Nedtsvetsky. Professor Mikhailenko was the chairman of the photo club for all time of its existence. The staff of the club was divided into three groups: professors – 3 people; laboratory assistants and teachers who did not have the status of professors - 2 people; students - 59 people (Belov, 1914: 76).

As it was mentioned in the article, the activity of the photo club increased every year in the volume and number of directions, which was confirmed by specific figures (Table 3).

Table 3. Indicators of the activities of the photo club established at the Tomsk Technological Institute (Belov, 1914: 77)

Indicators	Years	
	1910	1913
Number od members, people	38	64
Incoming, rubles	269	526
Expense, rubles	257	466
Purchased inventory for the amount of, rubles	164	181
Spent on the purchase of supplies for the photographic work, rubles, including:	70	247
Reactives, rubles	28	84
Paper, rubles	42	106
Photographic plates rubles	-	57

As A. Belov pointed out in his review, the laboratories of the photo club were never empty and were open from morning till late in the evening. In addition, they were often crowded with visitors. Often it was necessary to conduct long lines of students who expressed a desire to work with reproductive magnification devices (Belov, 1914: 77).

Among other successes, the high popularity and attendance of exhibitions organized by the forces and members of the Tomsk photo club were especially mentioned. In the paper of A. Belov, information is provided that only at the first exhibition of this student' organization more than 1,500 visits were officially registered. The second exhibition, in comparison with the first one, was even more equipped with various exhibits. Also, it was distinguished by a great variety of processing of papers and photographic plates, that is why people wishing to attend the event did not decrease, but, on the contrary, they only increased (Belov, 1914: 78).

Also the aero club, founded at the Tomsk Technological Institute in 1910 enjoyed the great popularity among Siberian student youth. As a key goal of the work of this student organization, it was stated the increasing of students' knowledge in the aviation field. Among the key work areas and activities implemented within the club, there were:

- lectures and reports on aviation;
- the organization and participation in exhibitions of models of flying machines;
- attempts to assemble an airplane by the members of the club;
- collection of funds for the functioning and development of the mentioned organization, including those through the organization of students' evenings and screenings of cinematography;
- organization of work and use of a library containing the literature on aviation issues, etc.

Among the successes and achievements of the aero club in the magazine there were indicated:

- acquisition of its own airplane in 1913;
- conducting several flights on an airplane;
- high attendance of speeches and reports on aviation subjects, which reading was more than 200 people often attended by (Students'..., 1914: 77-78).

However, the successful club work had undergone serious failures over time. As the author of one of the articles, published under the pseudonym "Fail-aviator", noted in the "Siberian student", at one time the period came when the members of the club stopped flights because of the airplane failure. "There is an airplane and we would only fly, but, it is a small obstacle. One wing is broken, and no one wants to fix it, and we sit by the sea and wait for the weather ... it is unknown what will happen next," wrote "Fail-Aviator" in his note (Students' ..., 1914: 78).

Besides articles describing the purposes, tasks and important events in the activity of concrete student clubs, individual sketches and notes describing the general characteristic of the youth organizations position were also quite often published on pages of "The Siberian student". One of typical statements occurs in the article written by B. Yeniseiskiy where the following lines are given:

"The studentship experienced so heavy loss of strength that even scientific clubs began to suffer anemia. There was no wish either work, nor to think, it was so dark around, was so heavy, disturbing in soul. The spirit of ideological proximity and support has been expelled from various organizations" (Yeniseiskiy, 1915: 35).

5. Conclusion

Summing up the result, it is possible to note that the articles published at the beginning of the 20th century in «The Siberian Student», in whole or in part devoted to student clubs' activity more often contained criticism of their current situation, complaint to the shortage of material benefits, the equipment and facilities.

Nevertheless, the significant mission, noble purposes and tasks formulated initially by organizers of clubs and their members were also emphasized almost in all articles of this thematic series. As a rule, authors of materials appealed student's youth not to lose courage, and, despite all difficulties and problems, to continue to study the native land, to be engaged in creative and scientific activity for the sake of the Homeland, public wellbeing and prosperity.

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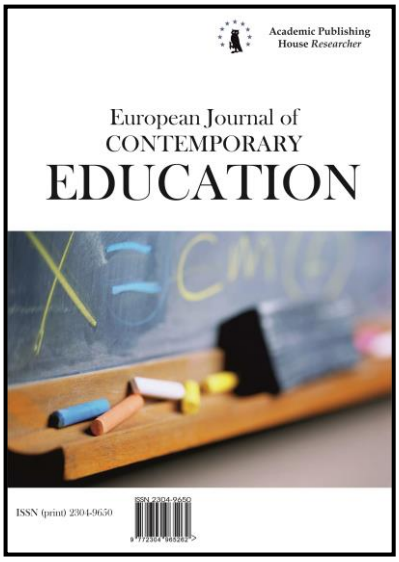
Published in the Slovak Republic
European Journal of Contemporary Education
E-ISSN 2305-6746
2018, 7(3): 623-629
DOI: 10.13187/ejced.2018.3.623
www.ejournal1.com



Development of Primary Public Education System in Serbia in 1832–1882

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Abstract

The article examines the history of the system of primary education in Serbia from the time of the organization of public schools in 1832 to the introduction of general primary education in 1882. The dynamic of the opening of schools and the number of students in schools is presented in the study.

Scientific and reference literature on the research topic was used as materials. The methodology used a set of scientific methods: multi-factor and integration methods, periodization, typology, comparison, etc., which in unity ensure the reliability of the results on the studied problem. This is an interdisciplinary research, based on the comparativistic principle, which allows revealing various informative sources.

In conclusion, the authors note that during the period of 1832 – late 1890's the primary school in Serbia experienced a period of its dynamic development, from its formation till the introduction of general primary education. This period was a difficult one, as it was necessary to overcome not only the complexity of the financing of primary education, but also a part of Serbia often became a place for political and military conflicts. Along with these reasons were purely domestic ones – the unwillingness of parents to send their children to school. The work of the Serbian Ministry of Public Education was focused on these difficulties, and the majority of this work was completed by the end of the 19th century.

Keywords: public education, elementary schools, Serbia, primary education, 1832–1882.

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1. Introduction

Serbia entered the XIX century without a system of public education. The Ottoman Empire, which controlled Serbia for nearly 400 years, did not introduce any school education and was limited only by Muslim religious schools. In this regard, the Serbian priests and monks tried to develop education in monasteries. Almost every monastery conducted work in the field of education, but this work was specific. According to Vuk Karadžić, the reformator of the "new Serbian Principality": "The majority of those who studied in monasteries could not even write and count after 4-5 years of studies" (Rozen-Chudnovskii, 1870: 259). The main reason for this was that the students did not read any books in 2-3 years, but they studied rural life in practice: they plowed, sowed, mowed, chopped wood for the monastery, etc. In the remaining two years, the learning process took place only in the winter, and the summer months again were devoted to field work. In addition to the monasteries, priests opened schools for village children, but the number of students there almost never exceeded 3. There was one more type of school – master's schools, called so because teachers in them were called masters. In master's schools students were taught religious literature and the basics of writing.

2. Materials and methods

Scientific and reference literature on the research topic was used as materials. The methodology used a set of scientific methods: multi-factor and integration methods, periodization, typology, comparison, etc., which in unity ensure the reliability of the results on the studied problem. This is an interdisciplinary research, based on the comparativistic principle, which allows revealing various informative sources.

3. Discussion

Various aspects of the history of the system of primary education in Serbia in the period of the XIX century began to be considered since the 1870's. One of the first publications on this topic were the works of Rozen-Chudnovskii (Rozen-Chudnovskii, 1870; Rozen-Chudnovskii, 1870a). The author analyzed the system of primary and secondary education in Serbia in 1830-1860.

L. Trgovčević studied women's education in Serbia (Trgovčević, 2011). It is important to note that, along with women's education, the researchers turned to the topic of academic and intellectual exchanges of Serbs with the representatives of the other peoples of Europe (Stoianovich, 1959).

The pedagogical problems of Serbian innovators, published in the XIX century (Bakic, 1878; Bakic, 1897), researches in the field of school education (Cunkovic, 2016; Nikolova, 2017), as well as works on the formation of the Serbian intelligentsia (Karanovich, 1998; Paunic, 1998) can be mentioned among other problems covered within the research.

4. Results

The situation with the system of public education began to change fundamentally only in 1804, during the first Serbian uprising, when Serbia became independent. At this time, the Serbian voivode Kara-Georg Petrovich established several state elementary schools. The teachers from these schools became officials and received salaries from the treasury. In 1808 Kara-Georg Petrovich founded the so-called "Great School", similar to the Lyceum. Unfortunately, after the suppression of the first Serbian uprising in 1813, the school was closed.

Until the early 1830's the initiative in the field of public education belonged to private investors or to rural and urban societies. In 1830, in Serbia, the first school was opened in Kragujevac (Rozen-Chudnovskii, 1870a: 241). In 1832, Prince Milosz, in addition to the gymnasium in Kragujevac, established 26 state elementary schools, and also provided support to the existing schools. As a result, in 1835/1836 there were 72 schools in Serbia, with a total of 2,514 students.

Table 1. Distribution of colleges by districts in 1835 (Rozen-Chudnovskii, 1870: 261)

№	Districts	Number of schools	Number of students
1	Belgradsky (with the city of Belgrade)	6	282
2	Valevsky	6	126
3	Shabachky	9	278
4	Podrinsky	1	32
5	Uzhichky	4	76
6	Chachansky	2	88
7	Rudnichky	1	42
8	Kraguevachky	9	253
9	Smedrevsky	4	173
10	Pozharevachky	8	222
11	Krainsky	5	216
12	Tsernorechky	2	67
13	Bansky (Gurgushevachky - Aleksinachky)	5	190
14	Chupriysky	3	211
15	Yagodinsky	9	146
16	Krushevachky	3	112
Total		72	2514

Table 1 shows that the number of children in schools ranged from 16 people in Jagodina district to 70 people in Ćuprija district. There were 34.9 people on the average per school in 1835.

All 72 schools in Serbia were divided into three categories: state-owned (26), social (27) and private (19). The administration of the public education system was carried out by the chief administrator.

ABC, the Psalter, the first four rules of arithmetic, the study of prayers, the sacred history and writing were in the curriculum. Catechism with Slavic grammar was studied only in a few schools.

Because of the state crisis in Serbia in 1837, state schools were transferred under rural society administration. It should be noted that rural societies were in a lack of finances, and this affected the financial provision of teachers, whose payments were constantly short of funds. As a result, the teachers began to resign and the education system entered a period of stagnation.

Nevertheless, the problem of public education required attention. On September 23, 1844, the government of Prince Alexander Kara-Georgievich (the son of voivode Kara-Georg Petrovich) adopted the “Law of school establishment”. In fact, it was the first legislative act of the system of public education in Serbia. The goal of public education according to the law was that it would provide the state with “good Christians, respectable people and useful citizens” (Rozen-Chudnovskii, 1870: 263). The Austrian school system was used as an example (Cunkovic, 2016: 63).

The Guardianship of Education (similar to the Ministry of Education) was responsible for the opening of colleges in Serbia. Actively lobbying the idea of increasing the number of schools, the Guardianship faced the first legislative problems. The fact is that the law stated that only 400 households had the right to demand the establishment of a school, that the school building should be only made of stone, and only some city societies could open 4-grade schools, but almost all schools were limited to 3 years.

These legislative restrictions were bound to inevitably slow the spread of literacy in Serbia, for the following reasons:

1) The Serbian villages in their majority were similar to Russian ones; 400 households in one village were a rarity. Consequently, with the establishment of one school for 400 households, children from 4-6 villages had to go to the same school, which presented a significant inconvenience for the students, both for educational and hygienic reasons;

2) The economic situation of villages in Serbia was in a decline and it was difficult and often even impossible to raise money for building a stone school. Many families couldn’t send their children to school for this reason;

3) There were a small number of gymnasiums in Serbia and all of them were located at considerable distances from each other. Therefore, for most children, education was limited to primary schools (Rozen-Chudnovskii, 1870: 264).

It should be noted that at that time Serbia was very limited in financial means and the problem of public education could not be solved easily. However, even these measures gave a positive result. In 1845/1846 school years in Serbia there were more than 200 schools with 6 thousand students (Table 2).

Table 2. Distribution of schools by districts in 1845 (Rozen-Chudnovskii, 1870: 264-265)

№	District	Number of schools	Number of students
1	City of Belgrade	7	399
2	Belgradsky	13	225
3	Valevsky	20	560
4	Shabachky	23	657
5	Podrinsky	10	369
6	Uzhichky	7	254
7	Chachansky	6	216
8	Rudnichky	5	158
9	Kraguevachky	21	561
10	Smedrevsky	9	327
11	Pozharevachky	26	784
12	Kraynsky	8	245
13	Tsernorechky	9	145
14	Gurgushevachky	4	105
15	Aleksinachky	6	189
16	Chupriysky	12	362
17	Yagodinsky	9	376
18	Krushevachky	6	149
19	Private schools	12	120
Total		213	6201

From the data in Table 2 it follows that the number of children in schools in 1845 ranged from 16 in Tsernorechky district, to 57 in the city of Belgrade. The very minimum indicator of the number of pupils was in private schools, only 10 pupils per school. On average, in one school in 1845, there were 29.1 people, that is, this indicator declined in the first decade.

According to the data in Table 2, during the 10 years of the operating of the public education in Serbia, the city of Belgrade became a separate educational unit, in addition, the Bansky District was divided into two – Gurgusovachky and Aleksinachky Districts and separate private schools were singled out.

The total number of teachers was 213 people, that is, one teacher per school. Thus, in 10 years the number of teachers increased by 141, and the number of students by 3687 people. On one hand, this result was satisfactory, but on the other hand, the population of Serbia, in 1816, was 980 thousand people. In developed European countries, no less than 10 % of the population attended schools, which meant that the number of students in Serbia should not be less than 98 thousand.

The schools were divided into 3-category and 4-category ones, the differences were in the subjects. Serbian and Slavic languages, ABC, the first four rules of arithmetic, the study of prayers, sacred history, catechism, geography, church singing and all-round knowledge were taught in 3-category schools. In 4-category schools, in addition to the above mentioned subjects the Serbian grammar, the history of the Serbian people and the triple rule of arithmetic were added to the 4th grade curriculum.

A serious problem for the public education system in Serbia was the lack of pedagogical staff. Almost all of the teaching staff was represented by young people who could hardly write and read.

There were no professors-instructors, no educational literature, no organization. The system was completely lacking the technique of teaching.

Nevertheless, the system of public education in Serbia continued to develop.

In 1855/1856 school years, the number of schools exceeded 330, with almost 10 thousand students (Table 3).

Table 3. Distribution of schools by district in 1855 (Rozen-Chudnovskii, 1870: 266-267)

№	District	Number of schools	Number of students
1	City of Belgrade	14	639
2	Belgradsky	35	317
3	Valevsky	22	595
4	Shabachky	27	966
5	Podrinsky	13	349
6	Uzhichky	16	536
7	Chachansky	14	392
8	Rudnichky	13	341
9	Kraguevachky	28	830
10	Smedrevsky	23	587
11	Pozharevachky	34	927
12	Krainsky	23	849
13	Tsernorechky	17	479
14	Gurgushevachky	11	357
15	Alexinachky	8	318
16	Chupriysky	15	459
17	Yagodinsky	18	555
18	Krushevachky	12	367
19	Private schools	4	108
Total		337	9971

From the data in Table 3 it follows that the number of children in schools in 1855 ranged from 9 in the Belgrade District to 39.7 in the Aleksinachsky District. On average, in the same school in 1855, there were 29.5 people, that is, during the decade this indicator remained practically unchanged.

Comparing the data of 1855 with the data for 1845, we find an increase in the number of schools by 132 and the number of pupils by 3802 people. At the same time, out of 337 schools in Serbia, there were already 18 girls' schools for 846 girls. The establishment of schools for girls in Serbia was long overdue, as the woman here played an important role in family and social life. The first girls' school was established in Serbia in 1840 in the city of Belgrade, but this institution was private and only for the girls from the upper class of the capital's society. In addition to women's crafts, they were taught the Serbian and German languages and geography.

The law of September 23, 1844 stated that girls have the right to attend primary schools, and in the villages boys and girls could attend one school, and in the cities girls' schools were to be established (Trgovčević, 2011: 7). The law also stated that girls could study at school only until they turned 10 years old. The first public school for girls was opened in Belgrade only in 1846, and even later in the other cities.

Girls' schools had 3 grades as they were of the third category. The only difference in the curriculum were women's crafts, all the other subjects were similar to boys' schools.

Some changes in the system of public education in Serbia towards improving education took place by 1855. The teachers began to use special methods to improve the pedagogical process, thus helped to spread the literacy. This was preceded by establishing intellectual ties between Serbian and German youth. Visiting fairs and exhibitions in Europe, participating in academic exchanges, they brought to Serbia, as M. Nikolova notes, a part of German culture (Nikolova, 2017: 4).

In 1858, the number of girls' schools in Serbia reached 30 (Trgovčević, 2011: 8)

In September 1863, Serbia issued a new law on primary schools. The new law improved the previous legislation on public education. So, the law didn't allow one school for 400 households,

and allowed any society to open a school, with at least 25 students. The new law eliminated the demand of the stone school building, replacing it with a spacious and light building. In addition, each school received the right to independently decide on the opening of the 4th grade (Rozen-Chudnovskii, 1870: 270).

Due to the introduction of the new law in Serbia, there has been a sharp increase in the number of students and a slight reduction in the number of schools, through the merging of schools (Table 4).

Table 4. The number of students in the districts in 1862/1863 and 1865/1866 (Rozen-Chudnovskii, 1870: 271)

№	District	1862/1863	1865/1866
1	Alexinsky	530	683
2	City of Belgrade	597	844
3	Belgradsky	951	1011
4	Valevsky	732	1027
5	Knyazhevachky (ex. Gurgushevachky)	550	664
6	Kraguevachky	1158	1462
7	Krainsky	929	1037
8	Krushevachky	431	631
9	Podrinsky	407	400
10	Pozharevachky	1716	2752
11	Rudnichky	508	579
12	Smedrevsky	715	1004
13	Uzhichky	837	964
14	Tsernoretsky	660	704
15	Chachansky	433	648
16	Shabachky	1167	1238
17	Chupriysky	670	850
18	Yagodinsky	608	909
19	Girls' schools in cities	1862	2400
Total		15461	19807

In 1865, one school on the average had 61.7 people, that is, over a decade since 1855, this figure doubled.

By 1865 the number of schools in Serbia reached 321, 289 for boys and 32 for girls. The teaching staff numbered 406 people (356 male teachers and 50 female teachers). Since that time, a teacher's training school at the gymnasium in Kragujevac was established in Serbia (Nikolova, 2017: 4). In addition, in 1864 two state schools (boys' and girls') for the Jews of the city were opened in Belgrade.

In 1882, Serbia passed a law on general education. By this time, the Serbian People's School had been divided into primary school with a 4-year education and a high school with a 2-year education. In addition to public schools, there were private schools in Serbia. In 1893-1894, Serbia had a population of 2288259 people with 914 elementary schools, 1505 teachers (929 male teachers and 576 female teachers) and 77175 pupils (65846 boys and 11329 girls) (Ehntsiklopedicheskii slovar' Brokgauza i Efrona, 1897: 741).

By 1893, one school in Serbia had 84.4 students, that is, after the introduction of general primary education, the number of students in schools increased by more than 2.5 times.

This data clearly demonstrates that by the end of the 19th century, the number of women among the pedagogical staff in Serbia had increased dramatically. This number was 38.4 %, while in 1865 this percentage did not exceed 12.5. Nevertheless, despite the introduction of general primary education, the percentage of girls enrolled in schools remained small. The reason for this was in the low awareness in the need of primary education for the girls.

In conclusion, we would like to present the dynamics of the opening of primary schools in Serbia during the studied period in the summary table (Table 5).

Table 5. Summary data on the development of the primary education system in Serbia in 1832-1894

Years	1835	1845	1855	1862	1865	1893
Number of schools	72	213	337	-	321	914
Number of students	2514	6201	9971	15807	19807	77175
Average number of students per school	34,9	29,1	29,5	-	61,7	84,4

From the data in Table 5 it follows that in the period from 1855 to 1865, there was a reduction in the number of schools with a simultaneous increase in the number of students. This reduction was due to the introduction of the law of 1863 "On primary schools", which clearly stated the minimum number of pupils per school.

5. Conclusion

Thus, during the period of 1832 – late 1890's the primary school in Serbia experienced a period of its dynamic development, from its formation till the introduction of general primary education. This period was a difficult one, as it was necessary to overcome not only the complexity of the financing of primary education, but also a part of Serbia often became a place for political and military conflicts. Along with these reasons were purely domestic ones – the unwillingness of parents to send their children to school. The work of the Serbian Ministry of Public Education was focused on these difficulties, and the majority of this work was completed by the end of the 19th century.

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