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**International Journal of Cognitive  
Research in Science, Engineering and  
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(IJCRSEE)**

**EDITORIAL**

**International Journal of Cognitive Research in Science, Engineering and Education (IJCRSEE)** is an open access international peer-reviewed, open-access journal, which provides a platform for highlighting and discussing various cognitive science issues dealing with the problems of cognition (and its evolution) within some specific subject field - philosophical, psychological, linguistic, mathematical, psychogenetic, pedagogical, ergonomic. Editorial Board strives to provide a possibility for the scientists of different fields to publish the results of their research, technical and theoretical studies. IJCRSEE is multidisciplinary in approach, and will publish a great range of papers: reports of qualitative case studies, quantitative experiments and surveys, mixed method studies, action researches, meta-analyses, discussions of conceptual and methodological issues, etc. IJCRSEE publisher is The Association for the Development of Science, Engineering and Education, Vranje, Serbia. Quality control, assisting and monitoring are supported by co-publishers:

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The main **aim** of the Journal is to discuss global prospects and innovations concerning major issues of cognitive science, to publish new scientific results of cognitive science research, including the studies of cognitive processes, emotions, perception, memory, thinking, problem solving, planning, education and teaching, language and consciousness study, the results of studying man's cognitive development and the formation of basic cognitive skills in everyday life. The Journal seeks to stimulate the initiation of new research and ideas in cognitive science for the purpose of integration and interaction of international specialists in the development of cognitive science as interdisciplinary knowledge.

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Each submitted manuscript is evaluated on the following basis: the originality of its contribution to the field of scholarly publishing, the soundness of its theory and methodology, the coherence of its analysis, its availability to readers (grammar and style). Normal turn-around time for the evaluation of manuscripts is one to two months from the date of receipt.

Submission of an original manuscript to the journal will be taken to mean that it represents original work not previously published, that is not being considered elsewhere for publication; that the author is willing to assign the copyright to the journal as per a contract that will be sent to the author just prior to the publication and, if accepted, it will be published in print and online and it will not be published elsewhere in the same form, for commercial purposes, in any language, without the consent of the publisher.

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**Writing** – Please write in good English (American or British usage is accepted, but not a mixture of these). For non-native English speakers, and perhaps even for some native English speakers, grammar, spelling, usage, and punctuation of the texts are very important for an effective presentation. Hence, manuscripts are expected to be written in a clear, cogent, and readily understandable by an international readership.

Manuscripts must be submitted online. Electronic submission reduces the editorial processing and reviewing time. As part of the submission process, authors are required to check off their submission compliance with all of the following items, and submissions may be returned to authors who do not adhere to the following guidelines:

The submission has not been previously published or presented to another journal for consideration (or an explanation has been provided in Comments to the Editor).

The submission file is in OpenOffice, Microsoft Word, RTF, or WordPerfect document file format.

Where available, URLs for the references have been provided.

The text is single-spaced; uses a 12-point font; employs italics, rather than underlining (except with URL addresses); and all illustrations, figures, and tables are placed within the text at the appropriate points, rather than at the end.

The text adheres to the stylistic and bibliographic requirements outlined in the Author Guidelines.

If submitting to a peer-reviewed section of the journal, the instructions in *Ensuring a Blind Review* have been followed.

A manuscript goes through the peer review process. Authors submit manuscripts to **Editorial office** via the online system. The acknowledgement letter should be sent to the author to confirm the receipt of the manuscript. The Chief Editor first reviews manuscripts. Chief Editor is assisted by Section Editors (could also be Co- or Associated Editors). The Editor assigns a Section Editor to see the manuscript through the complete review process and return it with a recommendation or decision. The manuscript is checked to see if it meets the scope of the Journal and its formal requirements. If it is incorrect or unsuitable, the author should be informed and the manuscript filed (or returned if requested) – direct rejection. Manuscripts that are not suitable for publication in the Journal are rejected. A Rejection letter is sent to the author stating the reason for rejection. If the manuscript conforms to the aims and scope of the Journal, and formally abides by the Instructions to Authors it is sent out for review. Depending on the type of paper, it could be accepted immediately for publication (invited Editorial, Book review etc) by the Chief Editor.

Check that the manuscript has been written and styled in accordance with the Journal style; that it carries an abstract (if applicable), keywords, correct reference system etc. and check that the correct blinding system has been used. If anything is missing ask the author to complete it before the manuscript is sent out for review.

The manuscript is sent out for review. The reviewer reads and evaluates the manuscript and eventually sends a review report to the Chief Editor. The time for review can be set to 2-6 weeks depending on the discipline (more time is usually given to papers in the humanities and social sciences). Make sure to provide the reviewer with clear instructions for the work, e.g. outlined in the form of a Review report or a number of questions to be considered.

Based on the reviewers' comments the Chief Editor makes a decision to:

- Accept the manuscript without further revision
- Accept after revision
- Ask authors to resubmit
- Reject

An acceptance letter is sent to the author and the final manuscript is forwarded to production. Sometimes, the authors are requested to revise in accordance with reviewers' comments and submit the updated version or their manuscript to the Chief Editor. The time for review can be set to 2-8 weeks depending on the discipline and type of additional data, information or argument required. The authors are requested to make substantial revisions to their manuscripts and resubmit for a new evaluation. A rejection letter is sent to the author and the manuscript is archived. Reviewers might be informed about the decision.

After review a manuscript goes to the Copy Editor who will correct the manuscript concerning the correct referencing system, confirmation with the journal style and layout. When Copy Editor finishes his/her work they send manuscripts to the Layout editor.

Layout Editor is responsible for structuring the original manuscript, including figures and tables, into an article, activating necessary links and preparing the manuscript in the various formats, in our case PDF and HTML format. When Layout Editor finishes his/her job they send manuscripts to Proof Editor. Proof Editor confirms that the manuscript has gone through all the stages and can be published.

This issue has 10 articles (9 original research and 1 review article). Our future plan is to increase the number of quality research papers from all fields of cognitive research in science, engineering and education. The editors seek to publish articles from a wide variety of academic disciplines and substantive fields; they are looking forward to substantial improvement of educational processes and outcomes.

Editor in Chief  
Asst. prof. Dr. Lazar Stošić

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# PERSPECTIVE OF COGNITIVE THINKING AND REFLECTIVE TEACHING PRACTICE

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## ABSTRACT

The factor analysis was used to ascertain the factors reflecting the most important attitudes of the respondents concerning reflective thinking in the classroom: self-evaluation, feedback and recording, improvement and analysis of teaching materials, assessment, concepts and misconceptions, construction of knowledge, metacognition and permanent improvement. The results of this research showed statistically significant differences among the aforementioned factors concerning the cycle of education (elementary school teachers and middle school teachers) and work experience (0-5, 6-10; 11-20; over 20 years of experience). The differences were obtained by parametric statistics, calculated using the t test and ANOVA test,  $p < 0.05$ .

Keywords:

*cognitive thinking,*

*permanent improvement,*

*self-evaluation,*

*reflectivity,*

*teaching practice.*

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## 1. INTRODUCTION

Reflective thinking has been discussed in the works of Dewey (1933) and Schön (1983). Dewey (1933, p. 9) asserts that reflection represents an active, permanent and careful consideration of any conviction or knowledge regarding its basic principles and further implications. This assertion demonstrates that reflection is a dynamic type of learning through understanding, changes, evaluation, estimation, analysis and synthesis, as well as a particular problem-solving technique based on an active change, careful gathering and association of ideas. Several decades later, Schön (1983; 1987) defines reflection as an advanced mental process that reaches beyond technical reality and involves intuition, insight and skillfulness, and is related to action and reflective practice (reflection-in-action and reflection-on-action). He particularly emphasizes critical reflection which he identifies with critical thinking. Thus, numerous authors identify

reflection with critical thinking which is related to constant introspection, review of personal thinking and permanent improvement and education (Feucht et al., 2017; Impedovo and Khatoon Malik, 2016; Ryan and Bourke, 2013; Roberts, 2016; Dyankova, 2018).

Ennis (2011a, 2011b, 1989), Scriven and Paul (1987) agree that critical thinking is focused on decision-making about action, reflective processes, alternative points of view concerning problems and queries, potential solutions. It is an intellectual process of an active conceptualization, application, analysis, synthesis and assessment of information obtained by observation, experience, reflection, communication and is based on universal intellectual standards of clarity, precision, accuracy, consistency and relevancy.

Critical thinking requires certain skills (Arsal, 2017; Facione and Gittens, 2013; Pithers and Soden, 2000), such as: focusing on the problem, defining assumptions related to the problem, inductive and deductive reasoning, assessment of reliability of assumptions and sources of information, analysis, generalization, analogy, evaluation, deduction, interpretation, explanation, self-regulation, problem-solving, participation, discussion and estimation.

Reflection occupies an important place in the education of teachers in Serbia and is particularly highlighted in *The Rulebook on*

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*Continuing Professional Development and Advancement of Teachers*, which are the documents that accentuate the necessity of the reflective practice in education.

*The Rulebook on Continuing Professional Development and Advancement of Teachers* (Official Gazette of RS, no. 81/2017) asserts basic rules related to teachers regarding their careers. These guidelines demand from teachers to demonstrate competence in a number of areas, including professional learning. The standards based on teachers' reflective abilities include the following: 1. Competence in the area of teaching, school subject and teaching methods (the teacher accomplishes functional and educational goals in accordance with general principles, goals and results of education, syllabus and curriculum of the subject taught, adapting them to their pupils' individual characteristics and abilities; continuously supervises and evaluates pupils' accomplishments using various ways of evaluation in accordance with the particular characteristics of the subject taught; prepares classes acknowledging accomplishment standards, teaching plans and programmes and pupils' individual differences); 2. Competence concerning teaching and learning (the teacher supervises and evaluates pupils' accomplishments and their self-evaluation; allows pupils to actively participate in teaching and learning; encourages pupils to express their own ideas freely, to ask questions, discuss and comment teaching topics; continuously stimulates the development and application of various thinking skills (problem-identifying problem-solving, decision-making) and forms of thinking (critical, analytical and divergent); plans activities according to pupils' knowledge and experience, their individual characteristics and needs, determined goals, results, contents and characteristics of the teaching surrounding; gives clear instructions and directs pupils to the transfer of knowledge); 3. Competence in stimulating the development of the pupil's personality (the teacher takes into account individual characteristics and the advancement level of each pupil when preparing and planning various educational and teaching activities; encourages pupils' motivation for learning; encourages and initiates pupils' personal responsibility for learning; plans the interaction of all those who are involved in education, which is based on the respect of differences and recognition of needs; considers pupils' opinion when evaluating their accomplishments; encourages initiative and free expression of pupils' thoughts, attitudes and convictions; respects the person-

ality and privacy of all pupils; evaluates their own work by the analysis and supervision of motivation, satisfaction, pupils' attentiveness in class, their independence and perseverance); 4. Competence in communication and cooperation (the teacher plans teaching as a member of a team; promotes initiative and free expression of pupils' thoughts, attitudes and convictions).

These standards stress the necessity of realizing one's own personal and professional work and they identify the necessity to improve skills and knowledge and to include other colleagues and larger networks of education workers into the improvement of teaching practice. Reflection is an important component of the programmes for the education of teachers. As regards the teachers in Serbia, reflection represents a rather contemporary issue which is the focus of this research.

## 2. MATERIALS AND METODS

### 2.1. The goal of the research

The significance of reflective practice in the context of schools, teaching and teachers' work has been discussed quite frequently. Reflection, reflective practice and reflective thinking are very important elements of both efficient teaching and professional development of teachers. The goal of contemporary teaching is the improvement of these concepts. The goal of this research is not only the indication of the importance of teachers' reflection but also the examination of teachers' attitudes to reflection in teaching practice.

### 2.2. Variables

The research established two independent variables. The first independent variable involves the education cycle which is operationalized into two categories comprised of elementary school teachers and middle school teachers. The second independent variable is teachers' work experience which is operationalized into four categories: teachers with 0 to 5 years of experience, those with 6 to 10 years of teaching experience, respondents with 11 to 20 years of experience in teaching and teachers with 20 years and more.

### 2.3. Methods and Instruments

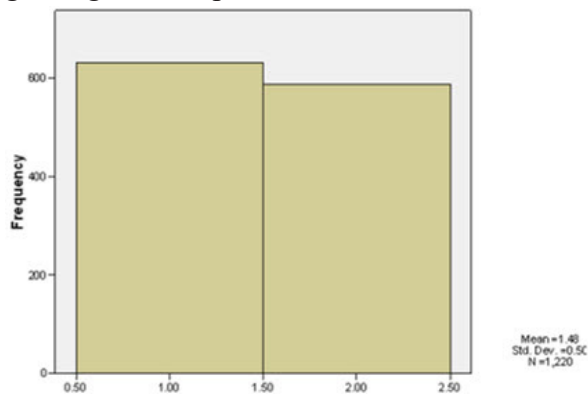
Data were collected using the descriptive method and the scaling technique. The Likert-

type scale was used to assess the results (from 1 – strongly disagree to 5 – strongly agree). A similar research was conducted by Hamilton (2005) who also explored three main areas of reflection: the ability of self-reflection, the manner of learning and the development of the skills of life-long learning. The instrument contained 33 items. Two independent variables were implemented in this instrument for this research: education cycle and work experience.

## 2.4. Respondents

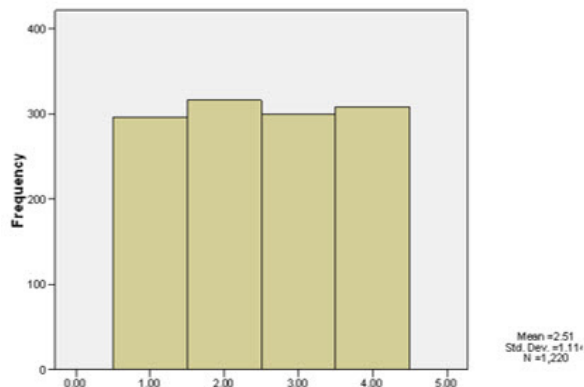
The sample of this research is deliberate. 1220 primary school teachers from Serbia participated in the research.

The following graphs show the structure of the respondents and their homogeneity regarding the independent variables.



**Graph 1:** Structure of respondents regarding education cycle

1220 respondents participated in the research (N=1220), 632 elementary school teachers and 588 middle school teachers (M=1.48; SD=0.50).



**Graph 2:** Structure of respondents regarding years of work experience

The number of respondents (N=1220) considering their work experience: 296 teachers with 0 to 5 years, 316 with 6 to 10 years, 300 with 11 to 20 years and 300 teachers with 20 and more years of teaching experience. This proves a relatively homogenous structure of the respondents (M=2.51; SD= 1.22).

## 3. RESULTS

The factor analysis was used to test the scale structure and it confirmed the factor structure of the instrument created by the authors Choy, S. C. and Oo. Pou San (2012). Kaiser-Meyer-Olkin test was 0.78, whereas Bartlett's test of the statistical significance showed a statistically significant result (p=0.00), which justified the use of the factor analysis in this research (Table1).

**Table 1.** KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.780
Bartlett's Test of Sphericity	Approx. Chi-Square	18999.041
	df	528
	Sig.	0.000

The factor analysis of the data extracted eight main factors that explained 63.63% of the variance (Table 2). The factor analysis extracted main research factors that were further statistically processed and analyzed.

**Table 2.** Factor analysis -factor extraction

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.926	20.987	20.987	6.926	20.987	20.987
2	4.648	14.084	35.071	4.648	14.084	35.071
3	2.159	6.541	41.613	2.159	6.541	41.613
4	1.693	5.129	46.742	1.693	5.129	46.742
5	1.568	4.751	51.493	1.568	4.751	51.493
6	1.514	4.587	56.081	1.514	4.587	56.081
7	1.332	4.036	60.116	1.332	4.036	60.116
8	1.071	3.244	63.361	1.071	3.244	63.361
9	.986	2.987	66.348			
10	.963	2.920	69.268			
11	.904	2.739	72.006			
12	.783	2.371	74.378			
13	.723	2.190	76.568			
14	.690	2.091	78.659			
15	.668	2.025	80.684			
16	.603	1.828	82.511			
17	.581	1.762	84.273			
18	.533	1.615	85.888			
19	.509	1.542	87.430			
20	.462	1.399	88.829			
21	.439	1.330	90.159			
22	.422	1.277	91.436			
23	.403	1.222	92.659			
24	.348	1.055	93.713			
25	.330	.999	94.712			
26	.293	.888	95.600			
27	.258	.781	96.380			
28	.251	.759	97.140			
29	.226	.684	97.823			
30	.204	.619	98.443			
31	.180	.546	98.988			
32	.175	.530	99.518			
33	.159	.482	100.000			

Extraction Method: Principal Component Analysis.

The factor analysis extracted the following factors:

1. *Self-evaluation* (I always think about what I do in classes in order to improve myself; I prefer obeying orders to being innovative in order to avoid trouble; I try to think about the materials I teach in order to improve my lectures).

2. *Feedback and recording* (I feel concerned about the feedback I get from my pupils since it is the assessment of and opinion about my personality; I think that the feedback obtained from my pupils is important because it helps me to understand them better; I consider the feedback I get from my pupils im-

portant because it is an indicator of my strong points and my drawbacks).

3. *Improvement and analysis of teaching materials* (I assume that my teaching method and teaching materials are indicators of my efficiency; I know that there may be some segments, such as particular materials and contexts, which may either improve or downgrade the lecture; I always try to connect the materials I teach to my life experience).

4. *Assessment* (I regard my mistakes as some experience that will help me to do better in the future; I know that I make mistakes but I sometimes think that I cannot do anything about that; Being a teacher, I am fully aware of

the fact that my mistakes may have an impact on the lives of my pupils).

5. *Concepts and misconceptions* (I do not take into account the feedback obtained from my pupils; I dismiss it as being merely their opinion; I disregard it as long as I believe I do my work well; I think that the feedback obtained from my pupils is important because it helps me to correct my teaching methods, which will guarantee my better performance in class; I am willing to consider my previous lectures and integrate them into my present teaching in order to be better prepared for the future work).

6. *Construction of knowledge* (I show interest only in the class I teach, I basically have no time for or interest in talking to colleagues about the teaching strategies and goals they establish in their classes; I want to know how effective my teaching is, so any feedback from my superiors is useful for me; My pupils do not learn in the same way as I used to, so I need to examine new teaching strategies in order for them to remain relevant in the future).

7. *Metacognition* (I teach in a certain way that suits me, I do not know why I teach like that but I simply do; I want to do my own, individual research in order to gain certain knowledge on how to teach or how to educate myself to become a better teacher; I try to think about my lectures and teaching so that I can improve and enhance teaching strategies and use novel and efficient ones; Sometimes I may obtain some information from conversations with colleagues who teach different subjects).

8. *Permanent improvement* (The feedback that I get from my pupils and my superiors is sometimes so vague that I do not know how to proceed with it; I do not think that the feedback can help me to learn how to teach better; I am aware that I am still learning to become a better teacher and that this process can be facilitated by the feedback obtained from my pupils and my superiors; I know that I have learnt about my profession all my life; I have already encountered some problems that I have overcome owing to my resourcefulness, but I still think the feedback from my pupils and superiors would be very helpful in the improvement of my teaching).

**Table 3.** Differences in respondents' opinions regarding the education cycle

	Education cycle	N	M	SD	t	df	p
SELF-EVALUATION	Elementary school teachers	632	12.29	1.64	-3.05	1218	<b>0.00</b>
	Middle school teachers	588	<b>12.58</b>	1.71			
FEEDBACK	Elementary school teachers	632	12.11	1.78	-0.45	1218	0.65
	Middle school teachers	588	12.16	2.04			
ANALYSIS OF TEACHING MATERIALS	Elementary school teachers	632	13.09	1.61	-1.32	1218	0.18
	Middle school teachers	588	13.21	1.61			
ASSESSMENT	Elementary school teachers	632	10.68	1.86	-1.90	1218	<b>0.05</b>
	Middle school teachers	588	<b>10.89</b>	1.95			
CONCEPTS MISCONCEPTIONS	Elementary school teachers	632	10.83	1.57	-1.23	1218	0.21
	Middle school teachers	588	10.95	1.73			
CONSTRUCTION OF KNOWLEDGE	Elementary school teachers	632	10.61	1.65	-3.71	1218	<b>0.00</b>
	Middle school teachers	588	<b>10.98</b>	1.84			
METACOGNITION	Elementary school teachers	632	11.50	1.67	-2.25	1218	<b>0.02</b>
	Middle school teachers	588	<b>11.72</b>	1.64			
PERMANENT LEARNING	Elementary school teachers	632	11.10	1.58	-1.58	1218	0.11
	Middle school teachers	588	11.25	1.73			

Table 3 shows the differences in the respondents' opinions as regards the education cycle. The difference is statistically significant in relation to the factors Self-evaluation, Assessment, Construction of knowledge and Metacognition and is  $p < 0.05$ . The comparison of the arithmetic means proves that those items that are characterized by a statistically significant difference were valued more positively by middle school teachers than by elementary school teachers. The reasons for this can be various. For instance, Serbian middle school teachers teaching from the fifth to the eighth grade are more experienced and teach many more classes than elementary school teachers, who teach only one class. On the other hand, one must not overlook the fact that teachers teaching higher grades are experts in their teaching areas. They teach only one school subject, which means that their reflection is focused on the evaluation of their work concerning only one teaching area, whereas

elementary school teachers need to reflect on a number of different school subjects and transfer their knowledge to their pupils, but also to critically reconsider the results of their teaching and all the elements of reflection concerning various teaching areas. In comparison to middle school teachers, self-evaluation, assessment, adaptation of knowledge to different pupils from different classes are the factors that are prevalent among elementary school teachers. Other factors, such as Feedback, Analysis of teaching materials, Concepts and misconceptions, do not show any statistically significant difference. The answers of both categories of respondents are homogeneous,  $p > 0,05$ . Table 4. Differences in respondents' opinions regarding years of work experience Table 4. Differences in respondents' opinions regarding years of work experience.

**Table 4.** Differences in respondents' opinions regarding years of work experience

		N	M	SD	F	p
SELF-EVALUATION	0-5	296	12.25	1.73	2.028	0.10
	6-10	316	12.58	1.82		
	11-20	300	12.48	1.63		
	over 20	308	12.40	1.49		
	Total	1220	12.43	1.68		
FEEDBACK	0-5	296	12.02	1.98	10.231	<b>0.00</b>
	6-10	316	11.70	2.23		
	<b>11-20</b>	<b>300</b>	<b>12.46</b>	1.77		
	<b>over 20</b>	<b>308</b>	<b>12.36</b>	1.48		
	Total	1220	12.13	1.91		
ANALYSIS OF TEACHING MATERIALS	0-5	296	13.27	1.31	5.302	<b>0.00</b>
	6-10	316	13.20	1.58		
	<b>11-20</b>	<b>300</b>	<b>13.30</b>	1.40		
	over 20	308	12.84	2.03		
	Total	1220	13.15	1.61		
ASSESSMENT	0-5	296	10.89	2.26	1.555	0.19
	6-10	316	10.79	1.92		
	11-20	300	10.88	1.77		
	over 20	308	10.59	1.60		
	Total	1220	10.79	1.90		
CONCEPTS AND MISCONCEPTIONS	0-5	296	11.06	1.86	1.746	0.15
	6-10	316	10.89	1.42		
	11-20	300	10.82	1.65		
	over 20	308	10.77	1.65		
	Total	1220	10.89	1.65		
CONSTRUCTION OF KNOWLEDGE	0-5	296	<b>11.04</b>	1.82	3.795	<b>0.01</b>
	6-10	316	<b>10.86</b>	1.59		
	11-20	300	10.60	1.86		
	over 20	308	10.67	1.72		
	Total	1220	10.79	1.75		
METACOGNITION	0-5	296	<b>11.67</b>	1.75	6.324	<b>0.00</b>
	6-10	316	<b>11.79</b>	1.61		
	11-20	300	11.44	1.70		
	over 20	308	11.40	1.54		
	Total	1220	11.60	1.66		
PERMANENT LEARNING	0-5	296	11.36	1.64	2.473	0.06
	6-10	316	11.11	1.50		
	11-20	300	11.21	1.72		
	over 20	308	11.01	1.74		
	Total	1220	11.17	1.66		

Table 4 shows the differences in the respondents' replies with regard to their work experience. The results were obtained using the ANOVA statistical technique. The differences were evident in the replies concerning the following factors: Feedback, Construction of knowledge and Metacognition, and they were  $p < 0.05$ .

In comparison to younger colleagues, the teachers with more years of work experience (11-20 and over 20 years of teaching experience) appreciated more the importance of the feedback obtained from their pupils. Moreover, the teachers with 11 to 20 years of work experience, with the highest arithmetic mean (Table 4), differ from less experienced colleagues regarding their opinions on the analysis of teaching materials, particularly the relationship between the materials they teach and their life experience. This difference is not surprising since the years of teaching experience can considerably influence all segments

of teaching and all contexts that can contribute to the improvement of teaching methods, and it was  $p < 0,05$ . Young teachers suggested that pupils should acquire knowledge in a different way when compared to traditional education, which is the reason why they endeavoured to enrich their teaching strategies by introducing novel and more efficient ones. Also, young teachers developed metacognition, they learned how to become better in their profession and sought advice from other colleagues. As regards the examined statements, it does not surprise that young teachers valued more Construction of knowledge and Metacognition,  $p < 0.05$ .

## 4. DISCUSSION

Education in the Republic of Serbia is supervised by the Ministry of Education, Science and Technological Development. It is

divided into preschool (kindergartens), primary (elementary schools), secondary (high schools) and tertiary education (higher education schools of professional studies, faculties and universities). Primary education is subdivided into two cycles: the first cycle (from the first to the fourth grades, taught by elementary school teachers) and the second cycle (from the fifth to the eighth grades, taught by middle school teachers).

This research examined teachers' attitudes to reflection in primary school education. Two independent variables, education cycle and years of work experience, were used in the research. The education cycle was operationalized into two categories: elementary school teachers (from the first to the fourth grade) and middle school teachers (from the fifth to the eighth grade), while the second variable, the years of teaching experience, was operationalized into four categories: (0-5; 6-10, 11-20; over 20 years of work experience). The research demonstrated statistically significant differences in the respondents' replies concerning the factors such as Self-evaluation, Assessment, Construction of knowledge, Metacognition,  $p < 0.05$ . The observed difference showed that these factors were evaluated more positively by middle school teachers than by elementary school teachers. Moreover, a statistically significant difference was observed regarding the years of work experience, which confirmed that work experience could affect all segments of teaching and all contexts that can contribute to the improvement of teaching,  $p < 0.05$ . Young teachers suggest that pupils should be taught in a different, less traditional way and endeavour to enrich their teaching strategies. A number of contemporary authors (Cunliffe, 2016; Gorli, Nicolini and Scaratti, 2015; Pässilä, Oikarinen and Harmaakorpi, 2015; Ripamonti et al., 2016) have conducted theoretical and empirical research on the contribution of reflective practice to teaching efficiency. The results of these studies prove that reflective practice helps teachers to abandon impulsive and routine practice, create their daily tasks, act purposefully and appropriately, increase their own awareness of teaching, improve understanding and introduce positive changes.

Our research confirmed these results. It is important to constantly reassess the quality of teaching and exclude traditional teaching methods. The principles and strategies of teaching obtained from this research are expected to be applied in practice with the purpose of improving teachers' reflection, both

personal and professional, and their teaching methods. Therefore, their self-confidence will increase and their skills will be improved, which will all be very helpful in future challenging and demanding tasks imposed on them not only by the government documents but also by the altered roles in their professional work.

## 5. CONCLUSION

Contemporary society has brought about an altered vision of the teacher who no longer controls the teaching process but becomes an agent of critical change, accepting the role of a critical reflective practitioner. Reflection is beneficial for teachers since it enables them to acknowledge experience, assume a critical attitude towards practice, enhance their awareness of teaching, develop profound understanding, create positive changes (Bognar, 2013; Farrell, 2003). On the other hand, reflective practice is connected to the process of persistent and careful consideration of situations. Only those teachers who reflect on their practice do become more professional and efficient in teaching since only systematic reflection enables teachers to have an influence on making decisions that may cause changes in teaching practice (Larrivee, 2005). Reflective practice helps teachers free themselves from the constraints of a routine and impulsive behaviour.

Who is a teacher who is a reflective practitioner? This question reveals the basis of the definition of a teacher as a reflective practitioner. Reflection (serious thinking) + Practice (activities and action) = Reflective teacher, the teacher who reflects on what they do.

Such a teacher bases their teaching on research and critical consideration of their own actions, considers practice from various perspectives, discovers and understands their own assumptions, develops and changes their own practice and ensuing and relevant consequences. The goal of the reassessment is not for teachers to exclude these implicit pieces of knowledge and principles, but to become aware of them and use them in their teaching purposefully and intentionally. Metaphorically speaking, "The expression a reflective practitioner means that a teacher is supposed to look at their own image in the mirror and think about the reflection of their own teaching practice" (Radulović, 2011, p. 31).

The question may be raised: How new is the idea of reflection? Though rather popular,

it is not so new. This notion can be found in the works of Dewey (1933) and Schön (1983). The complexity of the teaching profession itself has always forced teachers to reassess and review their work and its results. However, this phenomenon has not been thoroughly examined and recorded. Thus, this research attempted to examine the reflection of teachers working in Serbian primary schools. Judging by the analyzed factors, this research suggests that some further study be conducted in pre-school, secondary school and tertiary education. Also, this issue may be explored from the angle of all levels of education in the Republic of Serbia.

The idiosyncrasy of this research is reflection on reflection. Notwithstanding the fact that teachers did not explicitly state what elements of reflection they were thinking about, this research might encourage them to consider their teaching in a different way.

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## Conflict of interests

The authors declare no conflict of interest.

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# PSYCHOLOGICAL CHARACTERISTICS OF THE VALUE ORIENTATION SYSTEM OF ARMENIANS IN TITLE ETHNOS AND RUSSIAN DIASPORA

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## ABSTRACT

The article substantiates the importance and relevance of studies on ethnic identity and value orientations, since they predetermine the assimilation of the spiritual culture of society, the formation of value orientations significantly contributes to the development of the individual. For that goal, a study was conducted with 160 bachelor and master students (ethnic Armenians and Russians living in Russia and Armenia) with a use of Twenty Statements Test and Schwartz's Value Survey. The results of the study allowed us to describe common characteristics of the value-semantic aspect of the ethnic identity in Armenian and Russian title ethnos and diaspora. Thus, we aimed to describe of the process of identifying and assigning the values in Armenians as a dual process: the acceptance of values, the norms of the group with which a person is identified; the comparison of himself and his group with others, which has a positive impact on the cohesion of his group.

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## 1. INTRODUCTION

The study of value orientations is relevant nowadays, since they influence the assimilation of the spiritual culture of society. Value orientations are responsible for the transformation of cultural values into motives and incentives for the actions of people. Consequently, the formation of value orientations contributes to the development of personality. The term "orientation" is used in many sciences, in psychology it has at least two mean-

ings: it describes the process and the result. Orientation as a process includes projective actions, from planning to the final result. It is the choice of goals, methods for achieving them, the assessment of the accuracy of actions and the comparison of actions with the plans, orientation and life values of the individual. Typically, by orientation as a result we mean mastering a wide range of knowledge and it assumes that the level acquired by a person is a kind of basis for continuous search and finding, deepening and improving ideas and knowledge. In this case, orientation implies a certain emotional state of confidence in the loyalty of the chosen direction of the plan, thought and action. Orientation is the process of personal development, where the development, change and inclusion of its components gradually leads to high integrity. The accumulation of formation components, their reorganization and preservation, separation of functions, integration and hierarchy provide the opportunity for the emergence of

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new structural components and new functions of the value image of the world, the image of "Self", the image of the future.

At present, civilizational processes allow us to make conclusions not only about the internationalization of ethnic groups, but also about ethnic isolation, encapsulation, the desire to isolate from other ethnic groups (Stefanenko and Kupavskaya, 2010; Tajfel, 2010; Waterman, 1982). However, there are ethnic groups that develop in two planes, the hypotheses: in the conditions of residence in the title ethnos and in diaspora. The relevance of the study lies in the importance of studying the ethnic identity characteristics of Armenians residing on their territory and in conditions of migration. Armenia and Russia have historically been closely interconnected in the economic, socio-cultural, and spiritual spheres of living, despite the absence of geographic connectivity. Historical traditions were brought together and based on living in a single state, the USSR. In recent decades, the processes of migration flows, in particular, to Russia, have intensified, which actualizes the need to study the characteristics of ethnic identity, self-consciousness and the mentality of ethnic groups (Berberyan and Berberyan, 2016).

It should be noted that the ongoing modernization of most communities, the ever-growing share of mass culture, ethno-political integration, deep transformation of political and public life, are of interest to the problem of forming the identity of the modern generation, preserving the components of national identity and value-sense aspects of ethnic identity (Lebedeva, Tatarko and Berry, 2016; Soldatova and Geer, 2013).

The goal of the study is to identify the psychological characteristics of the value orientation system of ethnic Armenians in title ethnos and the diaspora.

The hypothesis of the study is the following: we assume that the normative and value foundations of the ethnocultural tradition and the features of self-understanding of ethnicity and the value structure are different in Armenians residing in title ethnos as compared to the ones residing in diaspora.

Value orientations are a complex multi-stage formation in which 3 main components are distinguished: emotive, cognitive, and behavioral. Emotive - the emotional aspect arising from the assessment; cognitive is an element of knowledge and, finally, behavioral - is associated with the implementation of value orientations in the behavior of the individual. Consequently, it is impossible to study value

orientations only with one method, since it is well known that a verbally expressed position of a person in relation to certain cultural values does not always coincide with his real behavior. Based on the main spheres of human social life, there are three groups of values: material, socio-political and spiritual. Material values are valuable objects and objects, namely the means of labor and things of consumption. Natural values should include natural benefits that are enclosed in natural wealth. Object values include objects of the material world created by human efforts and objects of the cultural heritage of previous years.

Socio-political values are the values of political and social events, phenomena, political actions and acts. Socio-political values include social welfare, which is contained in social and political movements and the progressive significance of historical events that contribute to the prosperity of society, cooperation among nations, and the strengthening of peace in general. Spiritual values are the normative and evaluative side of the phenomena of public consciousness and are expressed in the appropriate form (Berberyan and Berberyan, 2016). Spiritual values are considered to be the values of art, philosophy, science, morality and law.

Despite their differences, spiritual, material, and sociopolitical values are inter-related, and in each species there is an aspect of a different kind of values. In addition, there are some values that can be attributed to the material, and spiritual, and socio-political at the same time. First of all, these are values that have universal significance. Among them are freedom, health, life.

The most relevant problems of modern society are directly related to the spiritual and moral sphere of our being: the absence of the ideological base of meaningful orientation and the socio-cultural identification of students; a change in the mechanism of succession of generations, due to the general disintegration of culture, the erosion of the value basis and the traditional form of public morality; lowering the interest of young people to their national culture, traditions, history, to the carriers of national identity; decrease in the prestige of education as a method of social adaptation, cultural continuity and a form of self-realization of a person; low student activity in solving local, regional, national problems (Abakumova, Ermakov and Kolesina, 2016; Berberyan and Gabrielyan, 2019). As Fromm, E. (2013) notes, a large number of people fluctuate between different value

systems and therefore do not develop fully in a certain direction; such people have neither selfhood nor self-identity. Consequently, values are the core of the structure of personality and they determine its direction, regulate social behavior (Leontiev, 2017).

An important function of values is a prognostic function, since it is based on the development of a certain life position and various life programs, the creation of a plan for the future and the prospects for the development of the personality itself. That is, values regulate not only the present state of the individual, but also its future state; they define its life principles, its ideals, goals, objectives. Values, which act as a person's perception of due, mobilize vitality and abilities of an individual to achieve a specific goal.

## 2. MATERIALS AND METHODS

*Participants.* A total of 160 bachelor and master students (82 females, age range: 18-25) in Russian Federation and Armenia volunteered to participate in the current study. The participants represented four groups: (1) ethnic Armenians residing in Armenia, (2) ethnic Armenians, residents of Russia, (3) ethnic Russians residing in Russia, (4) ethnic Russians, residents of Armenia. For the descriptive statistics on participants see table 1.

**Table 1.** Descriptive statistics

	Participants	N
Sex:	Male	78
	Female	82
Age	18-21	123
	22-25	37
Residence:	Ethnic Armenians in Armenia	56
	Ethnic Russians in Armenia	23
	Ethnic Armenians in Russia	38
	Ethnic Russians in Russia	43
	<b>Total</b>	<b>160</b>

*Methods.* The following methods were used:

### 1. Twenty Statements Test

Twenty Statements Test developed by Kuhn, M. H. and McPartland, T. S. (1954) - is a psychodiagnostic technique, representing non-standardized self-description, in which the participant responds to an open question.

A participant is given 12 minutes to formulate twenty different answers to the question that is addressed to him: "Who am I?". Answers must be given in the same order in which they spontaneously come to mind. After that, the participant must evaluate each quality as positive or negative, or ambiguous, or use the sign that he is difficult to assess (?). The analysis of identification characteristics includes 24 indicators, the combination of which leads to the formation of seven generalized indicators-components of identity.

### 2. Schwartz's Value Survey

The Schwartz value test is used to study the dynamics of changes in values both in groups (cultures) due to changes in society and for a person due to his life problems. The basis of the Schwarz's questionnaire is the theory that all values are divided into social and individual. The questionnaire consists of two main parts: the first one is designed to explore the values, ideals and beliefs that affect the person (57 values). The second part of the Schwartz questionnaire is a personal profile. In contains a list of 40 descriptions of a person corresponding to one or another of the 10 types of values is given.

## 3. RESULTS

In the title Armenian ethnos, the participants' ideas about a typical Armenian woman and a man are similar in meaningful characteristics to the ideas of an ideal Armenian. In the assessment of men, the following values were highest: loyalty to friendship (4.52), respect for elders (4.29), religiousness (4.29), friendliness (4.20), and independence (4.19) dominate; in the assessment of women, friendliness (4.37), strength (4.24), loyalty to friendship prevail (4.22), hospitality (4.13), pride (4.07), courage (4.0). The rejected and low-valued qualities of a typical Armenian man are arrogance (1.16), naivety (1.28), rudeness (1.43), in the assessments of women - the ability to laugh at themselves (1.82), daydreaming (1.82), shyness (1.91).

In the assessment of a typical Armenian woman, the qualities of tact prevail in men

(4.22), emotionality (4.19), kindness (4.19), optimism (4.12), religiousness (4.09); in the assessments of women - hospitality (4.34), respect for elders (4.04). There is almost complete coincidence in the assessments of boys and girls of denied qualities: arrogance (0.46–0.39), rudeness (0.72–0.75), thievery (0.84–0.34).

Content analysis of the answers of the Armenian respondents showed that for them the “ethnocultural traditions” factor is the most significant (59.2% of the responses of men and 46.2% of the responses of women), among which the main ones are the native language (10% and 5%), compliance customs and approved rules of conduct (10% and 4.4%), features of upbringing in the family (4.8% and 3.6%), as well as knowledge and active use of folklore traditions (wedding ceremonies, music, dancing) (20, 1% and 18.4%). The second important factor is the value system (22% of the responses of men and 14% of the responses of women). This provision emphasizes such a value guideline as the conformity to the national ideal, the need to reproduce, in practical terms, forms of etiquette behavior expressing basic national values, which should contribute to creating a positive image of a representative of the Armenian ethnic group in a different ethnic environment. The third significant factor of self-understanding of ethnocultural affiliation is “ethnic solidarity” (concern for other representatives of the ethnic group, responsibility for the behavior and lifestyle of other Armenians) - 10% of the responses of men and 19.9% of the responses of women. Ethnic solidarity, support of compatriots and the formation of a positive image of representatives of their ethnos are of great importance for the Armenian respondents. Awareness of their cultural differences for the Armenian respondents leads to the desire to be worthy representatives of their ethnic group, they realize their own responsibility for shaping the image of a representative of an ethno-cultural community in the eyes of the ethnic majority. At the same time, the Armenian respondents are aware of their belonging to Russia, to the Russian people, therefore, ethnocultural identity in the diaspora is not opposed to civilian, it is recognized as its component, component, which leads to the realization of double responsibility for their actions, their behavior - before ethnic group, ethnocultural community and the country as a whole.

At the same time, in the female sample of representatives of the diaspora, in contrast to the male, the idea of a typical and ideal Ar-

menian coincides in many ways, significant differences were found only in the assessment of qualities: lack of egoism, lack of tendency to lie, reasonableness, tendency to make the same mistakes, patience, poise, emotionality. Thus, a typical representative of the Armenian ethnos, in the opinion of Armenian girls, is more selfish, emotional and less intelligent than ideally (Berberyan and Gabrielyan, 2019).

The elements of “Self-image”, in which there are no significant differences with the qualities of an ideal and typical man, include qualities: loyalty to friendship, conscientiousness, kindness, perseverance, resourcefulness, responsibility, religiousness, decisiveness, independence, restraint, strength, propensity to take risks, tact, respect for elders, stubbornness, as well as rejected qualities: rudeness, laziness, arrogance. There are no significant differences in the conception of oneself and the image of a typical man when assessing the rejected qualities: thieving, arrogance, naivety.

In the female sample, the elements of “Self-image”, in which there are no significant differences with the qualities of an ideal and typical woman, constitute the qualities of hospitality, respect for elders and denied qualities of thievery, arrogance, desire for “freebies”, rudeness. To the qualities in the evaluation of which there are no significant differences of the “Self-image” with the qualities of an ideal woman, the respondents attributed loyalty to friendship, mutual assistance, willingness to help, good nature, good faith, kindness, friendliness, sincerity, love of order, optimism, responsibility, responsiveness, hard work, diligence mind.

In the conditions of the diaspora, the Armenian youth self-image practically coincides with the idea of a typical Armenian, respectively, men evaluate themselves in the context of normality, which differs significantly from the norm.

On the contrary, the image of themselves among Armenian girls practically coincides with the idea of an ideal Armenian. The significant coincidence of the estimates of the ideal and typical representative of the ethnos, as well as the self-image in the female sample, indicates the desire of girls to reproduce normative ethnocultural patterns.

### 3.1. Comparative analysis of the results of Armenians and Russians in title ethnos and diaspora

According to the results of Twenty Statements Test, the following results were obtained: 1. ethnic Armenians of the titular ethnic group in 38% use Reflective Self statements when describing themselves, 35 % uses statements related to Social Self, , 2. among ethnic Armenians of the Russian diaspora in 37% the description appears through Social Self, in 36% respectively through Reflective Self, 3. 39% of ethnic Russians of the titular ethnic group use statements related to Social Self, 26% when describing themselves refer to Reflective Self. 4. Ethnic Russians of the Armenian diaspora in the majority of cases (39%) use Reflective Self, in 33% - Social Self. For overview of full results see table 2.

**Table 2.** The results of Twenty Statements Test for Armenians and Russians in Armenia and Russia

Self-description	Armenians in title ethnos	Armenians in Russia	Russians in title ethnos	Russians in Armenia
Social	35%	37%	39%	33%
Communicative	12%	7%	11%	0%
Material	6%	2%	3%	3%
Physical	4%	0%	1%	3%
Active	5%	17%	17%	7%
Prospective	0%	1%	3%	15%
Reflective	38%	36%	26%	39%

Thus, when describing themselves, the majority of participants, both ethnic Armenians and ethnic Russians, predominantly use the statements related to Social Self and Reflective Self. The statements related to Social Self include the use of family identity, civic and ethnic and educational-professional position.

The similarities between representatives of the Armenian titular ethnic group and Armenians residing in Russia were found based on the results of Schwartz value test: harmony (6.5 for Armenians in Armenia and 6.7 for Armenians in Russia respectively), freedom (6.7 and 6.1), the meaning of life (6.1 and 6.0), respecting parents (6.1 and 5.9) were found to be the most significant values; the least significant for both groups were to obey the circumstances (3.1 and 2.3) and submissiveness (3.7 and 3.1). The analysis of the two groups

revealed the following differences: the significance of the values “security of the nation” (3.78 and 5.9) and respect for traditions (5.0 and 6.7) was higher for representatives of the Russian diaspora, whereas independence (6.28 and 4.9) and self-confidence (5.1 and 4.0) was higher for representatives of the titular ethnic group.

A correlation analysis was carried out, on the basis of which the following results were obtained:

1. There is a statistically significant relationship between the value orientations of female and male respondents, the significance level is Sig (2-tailed) = 0,000, Pearson correlation = 0.869, which indicates a high correlation between these groups.

2. A statistically significant relationship was observed between the results of ethnic Armenians living in Armenia and Russia, Pearson correlation = 0.724 - a high correlation (Sig < 0.05). Additionally, a correlation was observed for the value orientations of Armenians residing in Russia and Russians residing in Russia 0.497 (Sig < 0.05), which is an indicator of a connection between the values of these groups.

## 4. DISCUSSIONS

The results of the participants from Armenia allowed us to highlight the similarities between a man and a woman in the respondents’ perceptions about themselves, while the rejected qualities are different. These results testify to the similarity in the perception of positive qualities and differences in the perception of rejected, negative qualities of “Self-image” in the self-understanding of Armenian students.

When comparing the estimates of the typical and ideal representatives of the ethnos by the young men, significant differences were found in almost all the scales, which indicates that the ethnocultural sample and ideas about the real Armenian are opposed in the minds of the respondents. This gap indicates the semantic plasticity and value saturation of the ethnic ideal with the instability of the normative component of the tradition.

When comparing the severity of qualities included in the structure of the “Self-image” and the images of ideal and typical representatives of the ethnos, significant differences were found in the results of the study of representatives of the title Armenian ethnos and diaspora.

The most significant differences in the value indicators of the residents of Armenia and the Armenian diaspora showed the value of security, which is based on the need for adaptability and predictability of the world, reducing uncertainty. The high significance of security in the value structure of the Armenian title ethnos has historical roots and is also largely due to the complex economic and geopolitical situation of today's Armenia. Values of hedonism (pleasure, sensual pleasure, enjoyment of life), stimulation (fullness of life sensations) and universalism (understanding, gratitude, tolerance and maintaining the well-being of all people and nature) are markedly less pronounced in the diaspora than in the title Armenian ethnos. It can be assumed that in the conditions of the Armenian diaspora in Russia, young people form an orientation towards activities that imply high rationality, activity, initiative, and the ability to compete.

The value of power (achievement of social status, prestige and influence on other people) is significantly higher in groups of representatives of the titular ethnic groups (Armenians and Russians) than among representatives of the diaspora. Accordingly, the formation of the values of representatives of the diaspora is influenced not only by the values of the representatives of the title ethnos in whose territory they live, but also the situation of the diaspora itself. The dual challenge facing the representatives of the diaspora: the adaptation to the culture of another ethnos and the preservation of cultural identity, makes less important the value of power and influence on others.

## 5. CONCLUSIONS

The results obtained make it possible to identify common features of the value-semantic aspect of the ethnic identity of a person both within the framework of the Armenian ethnos and different conditions of existence of this ethnic group - the title ethnos and diaspora.

As a result of the study, both general principles and features of the subject's inclusion in the cultural-historical tradition in the process of self-understanding of their ethnicity were identified.

The introduction of the individual to a particular culture is the process of forming an individual and unique system of values. In the process of mastering a culture, an individual is transformed into a personality, since a personality is a person, the combination of prop-

erties of which enables him to live in society as a full-fledged member, interact with people around him and realize activities for the production of various cultural objects.

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### Conflict of interests

The authors declare no conflict of interest.

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## SOCIAL COHESION IN EDUCATION: COGNITIVE RESEARCH IN THE UNIVERSITY COMMUNITY

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### ABSTRACT

The present article highlights the results of social cohesion study fulfilled in the university community of National Pedagogical Dragomanov University. It contains the consideration of social cohesion as an important factor of interpersonal communication, other social skills which are important for the community development. The purpose of the study was to identify the level of social cohesion for university community, to test the Bertelsmann Stiftung Model of Social Cohesion at the community level. Methods that were used in the study are synthesis, analysis, math, social questionnaire, etc. In the research the only data collection tool was the author's questionnaire. There were 112 people interviewed, among them 47 employees and 65 students of National Pedagogical Dragomanov University. According to the study results, the level of social cohesion in the university community is quite sufficient, which positively characterizes the attitude of employees and students to each other, reflects their readiness for mutual respect and support, acceptance of differences and tolerance etc. Also the research highlights weak points of social interactions that form the base for further investigations and actions on social cohesion development.

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## 1. INTRODUCTION

Modern cognitive researches are turning to the actual social issues of society development. One of them is the social cohesion which allows to involve all social actors in the society development and complex social problem solving. These problems are social isolation, social disintegration, poverty, violence communication etc. ([European Year for combating poverty and social exclusion, 2010](#)). While the concept of social cohesion is rather new,

since its basic principles were laid down only in 1990 within the framework of the Council of Europe, so there are many studies associated with it already: Social Cohesion Model, EU Social Cohesion Policy, Social Cohesion Radar etc. ([Dragolov et al., 2013](#)). We can discuss the cognitive aspects of this phenomenon and initiate the appropriate research because it covers many socially important issues simultaneously both on the individual and on the sub-individual (collective) levels of consciousness. The study of social cohesion is actual because it highlights very important problem of social areas, the “weak points” of social relations ([Bondarenko, Babenko, Borovskiy, 2017](#)). Cognitive mechanisms of social cohesion have neurobiological, evolutionary bases. Early in the human mankind's history there were some difficult periods when it was necessary to join each other for the surviving. These “rainy days” are happened quite often and periodically. Nowadays we are experiencing some kind of them – unpredictable and

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turbulent changes, financial and geopolitical crises etc.

The European Cohesion Policy is one of the answers to the challenges of the very fast changing modern society and it is deeply connected with European Education Policy. Lisbon strategy claims that education could be considered as the one of the key forming factors of the European social model. Education and social cohesion are connected in several directions. One of them is educational strategies oriented onto the social cohesion development – practices of intercultural dialog, non-violence communication, common problem solving techniques etc. Also these are techniques of better teaching and learning to enhance the social intelligence of students (Nesterova, 2019). Another side of the social function of education is establishment of social connections, social networks which sufficiently impact on the personal development and social adaptability of persons.

According to the World Bank Report “Social Cohesion in Education” the respect of diversity and intercultural dialog skill are quite important. There is one of the definition of social cohesion as a “societal, not an individual, phenomenon that includes the level of trust and understanding of shared principles among groups in a society” (Roberts-Schweitzer, E., Greaney, V. and Duer, K. 2006). The social role of education in the increasing of social cohesion is lied on the respect for diversity and it was quite clearly shown at the world conferences: World Conference on Education for All in Thailand (1990), World Education Forum in Senegal (2000) etc. Other international conventions, such as the Universal Declaration of United Nations on Human Rights (1948) and the Convention of United Nations on the Rights of the Child (1989), also promote this link between education and tolerance for diversity (Roberts-Schweitzer, E., Greaney, V. and Duer, K. 2006). They claim that education should be leading tool of social cohesion development which allows to avoid social exclusion and inequality. Understanding of the social cohesion as a social phenomenon is quite important for further investigations in the sphere of cognitive approaches in education, in particular, in the direction of social dimensions of cognitivism as a nonlinear complex of the human behavior and thinking, fundamental and applied cognitive researches (Nesterova, 2015). Social cohesion development is in the cross of economic and psychology problematics which impact on social behavior. Practices of intercultural dialog will

help to reduce inequality between members of one or more cultures (Nesterova, 2019), to improve the social cohesion, in particular the connectedness of educational communities.

We can maintain that the one of the main aspects of social role of education is social cohesion development. But at first it is necessary to determine this phenomenon. We can split off the social cohesion in separate features as tolerance, adaptivity to inequality, understanding etc. Thus, the model of social cohesion which will be described more properly below includes some cognitive parameters which are responsible for the social behavior. These parameters could be referred to social consciousness and social emotions. Synergetic approach claims that two independent parameters define the behavior of complex nonlinear system. Their dynamic balance could be the driver of its sustainable development (Nesterova, 2015). Emotional competence of individuals (which caused tolerance, adaptivity to various complex communication situations etc.) and social cohesion of social communities to be the parameters of this dynamic balance of sustainable society development.

Another social function of education is forming of values of new generation. It corresponds to the important demand of the society – common values platform for dialog, for social cohesion. In the education and other sphere of social innovations the significant space should be occupied by values as a driver of human behavior, impacting opinions, deeds and performance of an individual (Social Cohesion and Education). Some very substantial researches consider a social cohesion as a societal, not an individual, phenomenon that includes the level of trust and understanding of shared principles among groups in a society (Roberts-Schweitzer, E., Greaney, V. and Duer, K. 2006).

The role of social cohesion in education could be both positive and negative. The positive role of education in the development of social cohesion reflects in the understanding among people, reducing of violence in the educational dimensions etc. Obviously, in case of negative role of education (for instance, when it's not appropriately managed) it is fostering of economic, ethnic and other tensions (Roberts-Schweitzer, E., Greaney, V. and Duer, K. 2006). The key role of education in the social cohesion of communities is quite confident. Also educators have to be keepers and translators of the values, values of social cohesion in particular. So, this important task for educators to be translators of social co-

hesion values could be realized only in connected educational communities with the sufficient level of social cohesion. Therefore, the further investigations of the various aspects of social cohesion in education (e.g. in educational communities) are very actual directions of the cognitive researches in social and educational spheres. For instance, the social activity of youth in the university community is the subject of cognitive research (Shamionov and Grigoryev, 2019). Other aspects of social behavior, cognitive patterns of social cohesion in education in wider social context are also the subjects of the higher education studies, i.e. university-community partnership (Sasson, 2018). The project INCLUD - ED financed by European Commission in the 6<sup>th</sup> EU Working Program (2006-2011) was aimed to the practical aspects of social cohesion in education: social technologies and cognitive foundations of social cohesion in educational dimensions, in particular, in secondary schools (Alexiu, T. M. and Sordé, T., 2011). At the National Pedagogical Dragomanov University the authors developed the ideas of the INCLUD - ED and initiated some research projects which are implementing now. One of them is the project “Social Cohesion Development of Subjects of Educational Dimension”, supported by Ministry of Education and Science in Ukraine (Prof. Marja Nesterova is leading expert and project manager). The project is oriented to the key stakeholders of secondary schools (more than 160) among all Ukraine. The social role of education is clearly reflected in the practical results of the project: all participants are noticing the real enhancement of quality of communication, tolerance, dialog skills etc. The obtained results were the foundations of further investigations in the field of social cohesion aspects in education. One of them is Jean Monnet Module “Social Cohesion in Education and Governance: European Studies” (SCEGES) which is implementing now at the

National Pedagogical Dragomanov University (academic coordinator Prof. Marja Nesterova). The SCEGES project also is oriented onto the practical issues of social cohesion in education, e.g. social cohesion development in educational communities. But the sentence “you cannot manage, if you cannot measure” is still actual. Therefore, the problem of evaluation of social cohesion level in the communities demands the proper solution.

## 2. MATERIALS AND METHODS

The authors use the Bertelsmann Stiftung approach for social cohesion’s measurements. Originally the methodology of Bertelsmann Stiftung has been published at the report “The Social Cohesion Radar – An international Comparison of Social Cohesion” (2013). The report contains the evaluation of the social cohesion level in 34 advanced societies (27 member states of the European Union and seven other western OECD countries: Australia, Canada, Israel, New Zealand, Norway, Switzerland and the US) during four time periods from 1989. to 2012. This research has been created to measure social cohesion and its nine dimensions (Dragolov et al., 2013). The team of researchers from Jacobs University Bremen in Germany carried out the study belongs to a social reporting initiative of the Bertelsmann Foundation that aims to provide the general public with a conceptually and methodologically sound overview of the levels and trends of cohesion as well as an in-depth understanding of its determinants and outcomes” (Dragolov et al., 2013).

The Model of Social Cohesion by Bertelsmann Stiftung consists of three domains of social cohesion and their respective dimensions. The description of this model is in Table 1.

**Table 1.** The dimensions of social cohesion and their guiding principles (Dragolov et al., 2013)

Domain	Dimension	Guideline
Social relations	Social networks	People have strong, resilient social networks.
	Trust in people	People have a high level of trust in others.
	Acceptance of diversity	People accept others with the different lifestyles and values and lifestyles
Connectedness	Identification	People feel strongly connected to their country and identity with it.
	Trust in institutions	People have a high level of confidence in social and political institutions.
	Perception of fairness	People believe that society’s goods are fairly distributed and that they are being treated fairly.
Focus on the common good	Solidarity and helpfulness	People feel responsibility for others and are willing to help them.
	Respect for social rules	People abide by the fundamental rules of society.
	Civic participation	People participate in society and political life and enter into public discussions.

It is important to notice that the Bertelsmann Stiftung's approach to measuring social cohesion is based only on secondary data analysis. This method reuses data already collected by researchers to answer similar or same research questions. The method is universally applicable and its application is expedient in social sciences. For example, Smith shows that 75% of articles related to empirical analysis in the three authoritative British sociological journals use secondary data (Smith, 2008).

This approach has been continued in the sociological research of scientists from Taras Shevchenko National University. They presented results of the research of social cohesion based on the secondary data from the sixth European Social Survey (Bondarenko, Babenko, Borovskiy, 2017). The explanation of the measurement of social cohesion as a social phenomenon due to paradigm shift in approaches to measuring the quality of life of societies is proposed. This involves consideration of social cohesion as a weighty factor for measuring the social quality of life. The method used by Bertelsmann Stiftung, which was tested on the available data of the European Social Survey of the Sixth Wave, which included Ukraine, was used for this, and was additionally certified through the analysis of other sources. The study made it possible to make a number of meaningful conclusions about the level of social cohesion in Ukraine compared to other European and world countries. The recommendations for further research of social cohesion are given.

We have analyzed the social cohesion of the representatives of university community of National Pedagogical Dragomanov University (NPDU): employees of NPDU (mostly lecturers) and students. The purpose of the study was to identify the level of social cohesion for university community, to test the Bertelsmann Stiftung social cohesion model for application at the community level, not the country.

As we described earlier the Bertelsmann Stiftung social cohesion model has the three main domains which are: social relations, connectedness and focus on the common good. These domains are divided into 3 dimensions and characterizes people for each of them. So "social relations" covers social networks, trust in people and acceptance of diversity. "Connectedness" comprises identification, trust in institutions and the perception of fairness. "Focus on the common good" covers solidarity and helpfulness, respect for social rules and civic participation. On the basis of this we have developed an author's survey method-

ology, which gradually reveals each of these domains and dimensions. Each dimension is revealed by 3 questions, which in total are 27 questions in the questionnaire. The questionnaire is designed both for assessing social cohesion in society, and modified for the educational sphere. So, on the basis of the study of social relations and relationships within this framework, we have the opportunity to find out how strong the social connection is in the community in which the survey is conducted. In our case, it is employees and students of the National Pedagogical Dragomanov University (Kyiv, Ukraine). That is, two groups of people belonging to the same community. Also, within this domain, we can determine how much people trust each other and how individuals treat and accept individuals with different values/ views / lifestyles.

Through the study of connectedness, we obtain results that allow us to analyze how strong the relationship is with the educational community in general and at smaller levels, and to identify or identify the respondents themselves with their community. Determining the level of trust in the institutions is important in the determination of social cohesion, since trust reflects the attitude towards its institution. The greater the level of trust, the better the relation to your environment. The fair attitude to itself is appreciated in order to find out what is perceived attitude towards yourself in your environment.

Evaluating a sense of responsibility one by one makes it possible to see how closely connected a community is, how people understand that their actions have an impact on others and take it into account in their activity.

Respect and observance of norms and rules reflect behavior that is adequate to social norms and without deviant deviations, which ascertains the attitude and respect for their social community.

The degree of participation in social/public and political life (Civic participation) depends on the social cohesion of both the individual and the collective as a whole. The greater the involvement in joint activities outside the working relationship, the greater the level of cohesion.

Twenty-seven questions of the questionnaire are evaluated on a scale of 1 to 5, where 1 is low, 2 is below average, 3 is average, 4 is above average, 5 is high.

There were 112 people interviewed, among them 47 employees of National Pedagogical Dragomanov University and 65 –

students.

### 3. RESULTS

We analyzed the answers of 112 respondents, which can be represented by table 2, which characterizes the level of cohesion as a whole on the respondents and presents data in the form of an arithmetic mean ( $\bar{X}$ ) and standard deviation ( $\sigma$ ), which allows to see how distributed the values obtained with respect to the arithmetic mean and make conclusions.

**Table 2.** Results of the assessment of the social cohesion level in the university community

Domains and dimensions	Arith. mean	Stand. deviation
<i>Social Networks</i>	3,71	0,71
<i>Trust in people</i>	3,81	0,67
<i>Acceptance of diversity</i>	4,28	0,68
<b>Social relations</b>	<b>3,93</b>	<b>0,49</b>
<i>Identification</i>	2,99	0,79
<i>Trust in institutions</i>	3,43	0,73
<i>Perception of fairness</i>	2,76	0,64
<b>Connectedness</b>	<b>3,06</b>	<b>0,44</b>
<i>Solidarity and helpfulness</i>	3,67	0,75
<i>Respect for social rules</i>	3,64	0,74
<i>Civic participation</i>	2,40	0,98
<b>Focus on the common good</b>	<b>3,24</b>	<b>0,57</b>

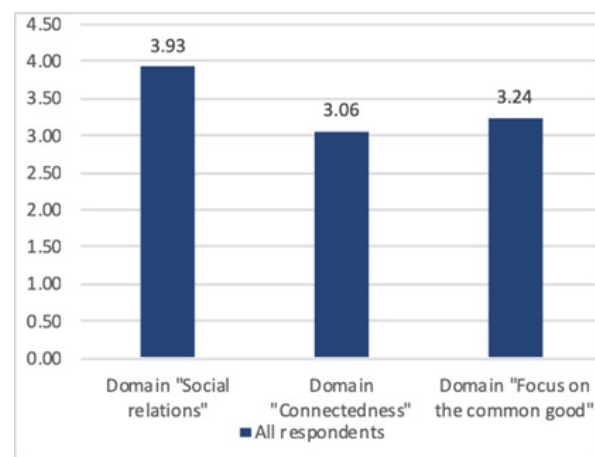
By assessing the overall level of cohesion in the NPDU, we can see that the indicators of the domains are at the average level, and the domain “social relations” is almost closer to the higher than the average ( $\bar{X} = 3.93$ ). This means that on the whole, according to the model of social cohesion, in the National Pedagogic Dragomanov University we have a sufficient level of solidarity, which shows the greatest importance both among employees and students of social relations. Analyzing the dimensions themselves, we see that in the domain of “social relations” the highest level - above the average - has received the dimension “acceptance of diversity”, that is, people with respect and tolerance towards those people who have other views, values, etc., that is very important in modern Ukrainian society, which is heading towards European values. In the second domain – “connectedness” - the

greatest importance is the trust in institutions ( $\bar{X} = 3,43$ ), and the least perception of fairness ( $\bar{X} = 2,76$ ). This characterizes the high level of trust on the whole NPDU and below average of how people feel fair attitude to themselves in it.

In general, the “connectedness” domain has the lowest rate among others, but it still has an average value.

Turning to the domain of “focus on the common good” we see that solidarity and mutual assistance ( $\bar{X} = 3.67$ ) and respect for social norms ( $\bar{X} = 3.64$ ) are the most represented here. The lowest value was civic participation ( $\bar{X} = 2.40$ ), which is more than 1 less than other indicators of this domain. It is also the smallest indicator of overall results.

The results of the evaluation of the domains of social cohesion are clearly shown in Figure 1.

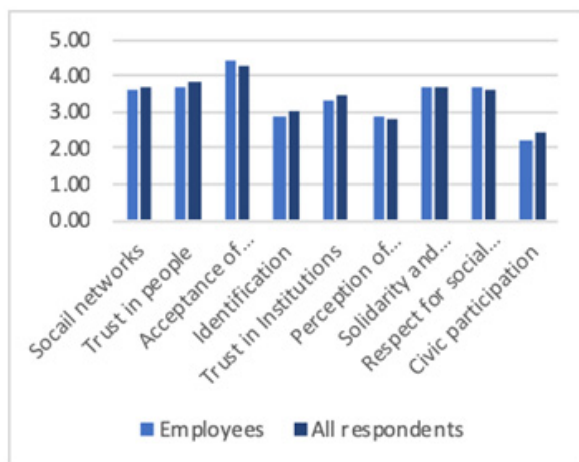


**Figure 1.** Results of social cohesion in the university community of NPDU by domains

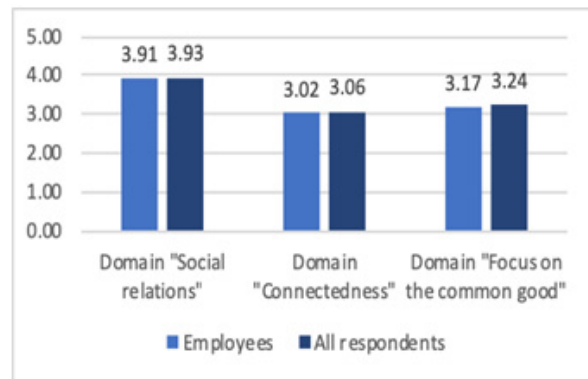
To find out whether or not there is a difference between the groups of respondents, we will analyze the indicators that characterize the social cohesion of the employees of this university (47 people). The results are shown in the Table 3. It is evident that in general they do not differ in large measure from the indicators for the NPDU as a whole. For greater clarity, see Figures 2 and 3.

**Table 3.** Results of the evaluation of the employees' cohesion in the university community of NPDU

Domains and dimensions	Arith. mean	Stand. deviation
<i>Social Networks</i>	3,62	0,72
<i>Trust in people</i>	3,70	0,68
<i>Acceptance of diversity</i>	4,42	0,80
<b>Social relations</b>	<b>3,91</b>	<b>0,57</b>
<i>Identification</i>	2,90	0,81
<i>Trust in institutions</i>	3,28	0,78
<i>Perception of fairness</i>	2,88	0,59
<b>Connectedness</b>	<b>3,02</b>	<b>0,49</b>
<i>Solidarity and helpfulness</i>	3,65	0,88
<i>Respect for social rules</i>	3,66	0,88
<i>Civic participation</i>	2,21	0,90
<b>Focus on the common good</b>	<b>3,17</b>	<b>0,59</b>



**Figure 2.** Comparison of social cohesion between all respondents and employees by dimensions



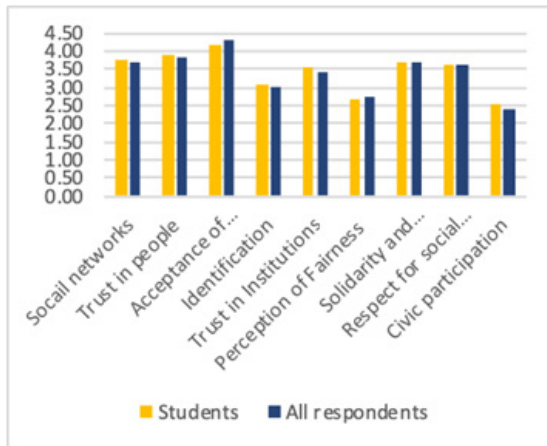
**Figure 3.** Comparison of social cohesion between all respondents and employees by domains

From the table and figures, we see that the levels of cohesion are almost the same. According to the domains from the employees, the data are approximately the same, that in general, relatively to the whole NPDU ( $\bar{X} = 3.91, 3.02, 3.17$ , respectively). There is also no distinctive difference in dimensions: all the data though vary in numerical form, the qualitative differences do not reflect and are at the same level. Separately, attention should also be paid to the last dimension – Civic participation, which has an even lower value for employees ( $\bar{X} = 2,21$ ), which is also less than 1 for other indicators of this domain.

Moving on to the analysis of the second group - students. In our representatives the number of students was 65. The results of response processing are presented in Table 4 and in Figures 4.

**Table 4.** Results of the evaluation of the students' cohesion in the university community of NPDU

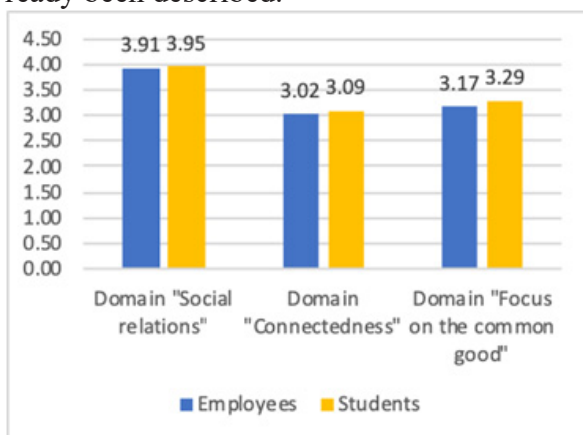
Domains and dimensions	Domains and dimensions	Domains and dimensions
<i>Social Networks</i>	3,77	0,69
<i>Trust in people</i>	3,89	0,65
<i>Acceptance of diversity</i>	4,18	0,55
<b>Social relations</b>	<b>3,95</b>	<b>0,42</b>
<i>Identification</i>	3,05	0,77
<i>Trust in institutions</i>	3,55	0,67
<i>Perception of fairness</i>	2,68	0,65
<b>Connectedness</b>	<b>3,09</b>	<b>0,39</b>
<i>Solidarity and helpfulness</i>	3,69	0,64
<i>Respect for social rules</i>	3,63	0,71
<i>Civic participation</i>	2,54	1,02
<b>Focus on the common good</b>	<b>3,29</b>	<b>0,55</b>



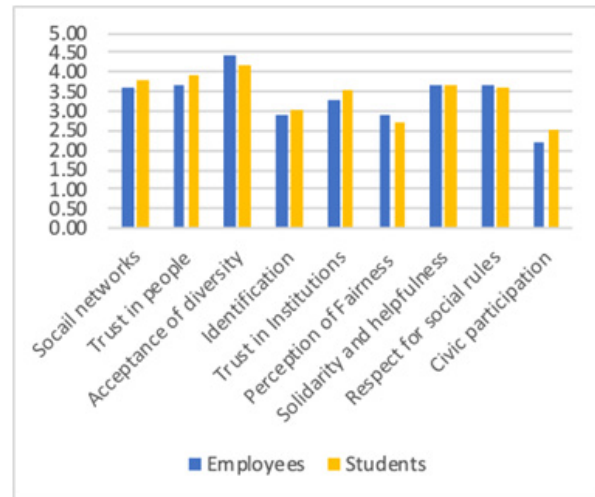
**Figure 4.** Comparison of social cohesion between all respondents and students by dimensions

The analysis of the results shows that the indicators for the spheres do not have a significant difference compared with the total for the whole community. All indicators are almost at the same levels that in general, according to the ROI, only the index of identification has a higher result than the average for the whole community - it reaches the average ( $\bar{X} = 3.05$ ).

If we compare the rates between the students and the employees (Fig. 5, 6), then we see that, in general, the domains do not have a significant difference, only the focus on the common good differs more than other domains ( $\bar{X} = 3.17$  from employees and  $\bar{X} = 3.29$  for students). Dimensions analysis shows that this is achieved due to the greater participation of students in public life ( $\bar{X} = 2,54$  against = 2,21 employees). In the other area there is no qualitative difference other than what has already been described.



**Figure 5.** Comparison of social cohesion between employees and students by domains



**Figure 6.** Comparison of social cohesion between employees and students by dimensions.

## 4. DISCUSSIONS

The obtained results make it possible to determine that, in general, the level of social cohesion in the university community of National Pedagogical Dragomanov University is at the average level, with a slight fluctuation. But most employees and students focus on social relations, rather than on connectivity and orientation to the common good. The least people are aimed at public engagement, which, in the opinion of the authors, is due to low culture and lack of experience in civic activity in Ukraine. People do not understand how this contributes to the development of society and their own well-being.

There is no significant difference in the level of cohesion between the indicators for the university community of NPDU in general and employees in particular. Similarly, employees are more focused on social relations, less on connectivity and orientation towards common good. The average level of cohesion indicates a sufficient level. The higher than the average rate of acceptance of the other kind testifies that the employees of the NPDU with respect to people with other values, have tolerance to each other and can cooperate in this. In the second domain, the values of identification and perceptions of equity among employees are lower than the average, which means their low identification with the NPDU and the same level of perception of fairness in relation to them.

In general, the analysis of the results of the student response process showed that almost the whole level of cohesion coincides,

besides connectedness, which characterizes their greater self-identification with the university than the employees. In another, the results can characterize students as those who believe in people, but less accept other values and differences, trust the institutions more, but perceive the attitude to them as fairness than employees, more than employees involved in public life.

We can further investigate these “weak points” in the social life of university community members – both students and employees. The next step is to compare social activity of students and employees in the external and internal social life of the educational community.

In the future the application of the research results would help to improve the social intelligence of educators, to improve their emotional competence skills, e. g. tolerance to diversity, intercultural dialog skills etc. It is presumed that the connected educational communities will enhance the level of social cohesion in education and society accordingly.

## 5. CONCLUSIONS

The role of education in social cohesion of communities is quite confident. But the phenomenon of social cohesion in education is not obvious and demands further investigations. Thus, the social cohesion in education could be considered from the focus of own connectedness of university community.

The Model of Social Cohesion by Bertelsmann Stiftung is very perspective for the research of the social cohesion in communities at the different levels – from cross-national to local. According to the above survey it could be applied at the level of educational community. In this concrete survey this model has been applied in the university community of National Pedagogical Dragomanov University (Kyiv, Ukraine). The aim of the research was to investigate the phenomenon of social cohesion in the education. The above research of social dimension of cognitive patterns of students and employees has been conducted in the university community to evaluate the real social cohesion level.

According to the obtained results we can maintain that the level of social cohesion in the university community of National Pedagogical Dragomanov University is quite sufficient, which positively characterizes the attitude of employees and students to each other, reflects their readiness for mutual assistance and re-

spect, acceptance of differences and tolerance, respect for social norms. However, there are some areas where the level of social cohesion of the whole university’s community can increase, and namely: achievement of indicators above average and high in all dimensions and domains. The data obtained for this research can form the basis for human resources management in the NPDU, so that employees are more likely to be treated fairly, identify themselves with the university, become more involved in public life both within and outside the university etc.

Speaking about cognitive aspects of social cohesion we lead to the successfulness in intrapersonal social communications and necessity to define the integral parameters of its development, monitoring and evaluation. This is the social (emotional) competence of social actors, in particular, educators. The social competence will lead to better quality of communication, tolerance to diversity, intercultural challenges etc. For educators as transformative actors for new generations the above key skills are strongly requested. Social cohesion development to be forced by some cognitive technologies. To find and implement them in educational community is a very complex and important task for educators as custodians and conductors of social values.

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### Conflict of interests

The authors declare no conflict of interests.

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# HIGH SCHOOL STUDENTS INVOLVED AND NOT INVOLVED IN MMORPG: CREATIVITY AND INNOVATIVENESS

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## ABSTRACT

The paper presents a theoretical and empirical analysis of involvement phenomenon in massively multiplayer online role-playing games among high school students. The characteristics of the virtual world are analyzed; its role in the life and activity of modern people is substantiated. The main features of the games that make them the most attractive to users and contribute to their active involvement in the game process are highlighted. The advantages of mass multiplayer online role-playing games are substantiated. On the basis of the theoretical analysis was formulated the aim of the study: to identify differences in the manifestations of innovativeness and creativity in high school students involved and not involved in MMORPG. Hypotheses about the existence of significant connections and differences in the manifestations of innovativeness and creativity in those involved and not involved in this type of games are formulated. The study involved 120 students of 10-11<sup>th</sup> forms and was based on the following methods: 1) questionnaire to assess the degree of enthusiasm in role-playing computer games; 2) questionnaire for the study of gaming activity, experience and gaming genre preferences of the individual; 3) self-assessment scale of personal innovative traits; 4) a multidimensional questionnaire "Innovativeness of a personality" - MQIP; 5) "Creativity" test. As a result of the study those involved in computer games are characterized by higher originality, imagination and creative thinking than their peers not playing massive multiplayer online role-playing games. The article presents a number of recommendations on the use of the plot potential of multiplayer online role-playing games for the development of high school students' personality in modern teaching practice.

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## 1. INTRODUCTION

Production of computer and game technologies firmly occupies a significant niche in the life of people in the XXI century and is of particular interest for the modern psychology of personality and psychology of gaming. Virtual world is becoming an integral part of reality, and its potential in influence the human psyche cannot be underestimated. It is

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important for modern researchers to study psychological, psychotherapeutic and developing possibilities of virtual space. The virtual world is an intangible environment that has a set of properties which allows considering the virtual world as an alternative to the physical world in psychological, social and economic sense (Belozarov, 2015).

Studies have shown that massive multiplayer online role-playing games or MMORPG (a genre of online computer role-playing games) are very popular among computer games fans (Luzakov and Omelchenko, 2012). The importance of studying both the content of the game and the psychological characteristics of MMORPG participants is due to the fact that the dynamics of changes in the level of involvement and the degree of this type of media influence intensity on a personality development can be best traced by the example

of this type of games.

Any product of modernity is inextricably linked with the concepts of creativity and innovation, as the level of their development at each stage, from the idea generation to ending with the finished product's promotion on the market, determines the success of the idea. Computer games are no exception, on the contrary, a unique, memorable product in this area, able to attract a large audience and maintain its interest for many years, must meet the high level of requirements, be creative, permeated with novelty and be competently advanced in the market, i.e. be innovative.

Those users of the media product, who have an adequate level of involvement, can fully use the acquired knowledge for their own purposes, i.e. to be more creative by studying a huge amount of new, interesting material and ideas obtained through the gameplay and integrated into the personality as a new experience, as well as to have a higher level of innovation, because the world of computer games is inextricably linked with the world of computer technology, which requires its users to constantly adjust to the endless stream of innovative changes.

Computer games, especially massive multiplayer online role-playing ones, have a number of advantages over any other product of the media which is the active inclusion into the process, the impact of decisions on the game outcome, the ability to live and act in the virtual world. Participants are attracted primarily by the opportunity to influence the processes taking place in the game world by making a certain set of decisions chosen from a variety of options provided by the game. Thus, the player is actively influenced by the program, which is able to form certain skills, behavior and social interaction stereotypes (Luzakov and Omelchenko, 2012; Pozharov, 2014). Features of creativity and innovation among MMORPG participants of senior school age are a relevant and widespread problem, the study of which will use the potential of computer games as a resource for personal development.

Over the past decade, there have been many studies that have described both the destructive and constructive impact of online multiplayer games on their participants (Van der Aa et al., 2009; Young and De Adreu, 2010; Graham, 2013; Koles and Nagy 2014; Kuss, Griffiths and Binder, 2013; Nasyrova and Petrova 2014; Voiskunskii, 2015; Kim, 2015; Sergeeva, Tsareva and Zinov'eva, 2017; Mikhailova, 2018). The virtual world can

significantly improve the quality of people's lives and destroy the adequate development of the psyche. A number of modern researchers (Frank, I., Sanbou, N. and Terashima, K., 2006; Voiskunskiy, 2015; Belozarov, S. A., 2015; Pozharov, A. I., 2004; Sublette, V. A. and Mullan, B., 2012) believe that mediated activities in virtual worlds can satisfy the basic human psychological needs. For disabled people with mobility problems, who are in a state of physical or social isolation, communication in the virtual world can be an effective means of social self-rehabilitation (Frank, I., Sanbou, N. and Terashima, K., 2006; Sublette, V. A. and Mullan, B., 2012; Dong, Wang, Yang and Zhou, 2013; Graham, 2013; Koles and Nagy 2014; Pozharov, A. I., 2004; Vilca and Vallejos, 2015; Voiskunskii, 2015; Belozarov, S. A., 2015).

The virtual space is considered by A. S. Belozarov as an environment alternative to the social and psychological problems of the real world. The researcher identifies several advantages that virtual space offers to a modern person: 1) subjective well-being; 2) friendly communities and strengthening of interpersonal relationships; 3) romantic relationships and positive emotions; 4) the state of group insight; 5) psycho- and self-therapy; 6) improvement of social conditions for disabled and physically/socially isolated people. According to the author, it is some "virtual reality analgesia" for traumas and problems of the real world (Belozarov, S. A., 2015, p. 75).

In the course of research, it was found that the satisfaction of social interaction, friendship and communication becomes as significant for the game participants as the game excitement (Frank, I., Sanbou, N. and Terashima, K., 2006; Belovol and Petrova, 2011). In addition, scientific sources claim that multiplayer online games are now played by families and friendly companies, thus maintaining common interests (Sergeeva, Tsareva and Zinov'eva, 2017). Multiplayer games form the skills to overcome difficulties, work in a team, and develop the social intelligence of participants (Yee, 2006). At present, the MMORPG plots are considered to be resources of personal identity formation (Shyrokanova, 2014), as a new kind of cultural communication (Pozharov, A. I., 2004), as the methods of active social interaction, which develop punctuality, leadership qualities, social interaction, time planning and decision-making (Shirokanova, 2014; Pozharov, A. I., 2004).

Russian authors' works demonstrate a

positive impact of computer games, including MMORPG, on the socio-psychological, personal characteristics of the involved players, as well as on the level of their self-consciousness (Kuss, Griffiths and Binder, 2013; Vilca and Vallejos, 2015; Hamade, 2018). This influence is determined by the player's need to enter a process in which there is a need to control the actions taken and to think over the consequences of such control, to analyze what is happening, to be focused, concentrated on the process of the game, to reflect, noticing changes in oneself, to participate in social interaction, through which the absence of such interaction in real life is compensated. Thus, the game is a source of rich experience for the individual, in which development is necessary to analyze one's achievements and failures, which leads to a change in personal structures, "self"- image and locus of control.

In his works, A. E. Voiskunskiy distinguishes psychotherapeutic effect from the gameplay: "convergence" of real "self" and ideal "self"; the importance of the experience of positive emotional experiences of a game situation; recreational functions of the computer game" (Voiskunskii, 2015, p. 6).

O. A. Nasyrova and O. A. Petrova emphasize the importance of computer games in learning, as they contribute to the development of perseverance, the formation of attention and persistence, and also help to organize the activities. It is also important to note that the computer game contributes to the development of hand coordination, visual perception and memory, organizational skills, develops the decision-making process. MMORPG can contribute to the development of communication skills, entry into social groups and overcoming shyness (Nasyrova and Petrova 2014).

In addition to works on the positive impact of computer games, there are a large number of studies aimed at studying their negative impact. There are such negative consequences of computer games as: changing the range of interests, its narrowing, the most active transformation of the motivational sphere in adolescence, their impact on cognitive abilities, escapism and autism, an increase in the level of aggressiveness and anxiety (Hamade, 2018; Widyanto and McMurren, 2004; Van der Aa et al., 2009; Young and De Adreu, 2010; Vilca and Vallejos, 2015).

The negative consequences of involvement in computer games include the formation of addictive behavior on the background of excessive abuse of time spent in the game.

However, when describing the dependence on mass multiplayer online role-playing games, it is important to note that their users are not only dependent on computer games, but also dependent on the Internet, as MMORPG is an integral part of the global network. Thus, those dependent on multiplayer online role-playing games will have psychological characteristics of both Internet-dependent people and people with gaming addiction: the emotional sphere instability, low level of self - control, low self-esteem, subordination to others, a tendency to be guided by feelings, sensitivity, high level of anxiety and tension, introversion as the internal orientation of the person, hostility, aggression, low stress resistance and low level of spontaneity.

However, for many users, this type of game acts as a hobby, a hobby that does not carry such disastrous consequences as gaming and Internet addiction, they can be described as involved in MMORPG. In foreign and Russian scientific literature, the terms "involvement" and "dependence" are used as synonymous concepts, so we see it necessary to separate them and describe the difference between involvement and dependence.

There are fundamental differences between addiction and involvement in the world of computer games. An addict experiences a pathological attraction to a dependency object and being distracted from it, experiences a growing desire to return. The inability to satisfy this urge for some time entails negative feelings — depression, anxiety, irritability, aggressiveness. The involved person does not have such strong negative consequences of distraction from the object of interest. The person can safely switch to other activities without discomfort if it is impossible to return to the object of involvement for a long time (Dong et al., 2013; Kuss, Griffiths and Binder, 2013; Graham, 2013; Vilca and Vallejos, 2015).

The interests and motives of the behavior of a person dependent on the game are subordinated to the main motive — to return to the object of dependence as soon as possible. All other activities fall into the focus of his attention only because they can serve as a means to achieve this goal. An addict finds it very difficult to concentrate, to remember, to bring to an end what turned out to be outside the dependency object. A person, who is free from dependence, even though he is involved, does not have such a prominent gap in the scale of priorities. The person involved keeps in touch with reality, does not avoid it (Yee,

2006; Kim, 2015; Hamade, 2018).

The factors that stimulate engagement in MMORPGs include: 1) initiation, immersion, interactivity, the game genre features' impact (the scale of the game world, its details, clarity and renewal); 2) the possibility of contact not only with the game, computer characters, but also with real people; virtual relationship between them can spill over into real communication; 3) the presence of social groups, guilds, clans, communities, associations of people; 4) the possibility of development of several characters in the game, with different skills, characteristics, abilities, conduct in the game; 5) an ability to personalize, individualize one's character.

On the basis of the conducted theoretical analysis it should be assumed that there are significant differences and specificity of relationships in the manifestations of innovation and creativity in groups of high school students involved and not involved in MMORPG. By innovation we mean an integrative combination of personality traits that provide perception, evaluation, refinement, operational and practical implementation of new, also original, ideas (Mikhailova and Kaminskaja, 2016). Creativity is defined in this paper as a cognitive component of the individual's innovative potential. Creativity, expressed by intellectual activity, is an integral part of the individual's innovative potential. If creativity is considered as a set of qualities that create an idea, then innovativeness is a set of personal qualities that allow to transform a creative idea into reality (Mikhailova, 2016; 2018; Tsai, 2018).

## 2. MATERIALS AND METHODS

Data was collected using the following research methods: 1) a questionnaire to assess role-playing games engagement levels (Belovol and Petrova, 2011); 2) a questionnaire for the study of gaming activity, experience and gaming genre preferences of the individual (the author - N. Omelchenko (Luzakov and Omelchenko, 2012)); 3) a self-assessment scale of innovative personality traits (Lebedeva, Bushina and Cherkasova, 2013); 4) a multidimensional questionnaire "Innovativeness of a personality" - MQPI (Mikhailova, 2016).; 5) "Creativity" test (N. Vishnyakova) (Kaptsov and Kolesnikova, 2011). To interpret and evaluate the data, comparative evaluation and correlation methods of statistical analysis were used: a nonparametric Mann-Whitney U-test, Spearman's rank correlation

coefficient.

The following students took part in the research: 10-11 form students of the municipal budget educational institution "Khot'kovskaya secondary school № 5" (Khot'kovo, Sergiyev-Posad municipal district, Moscow oblast) – 58 students in total (27 boys and 31 girls aged 16-17 years old) and pupils of Moscow general education institution, secondary school № 48, 62 students in total (31 boys and 31 girls). The final sample consisted of two groups: the first group — involved high school students (22 girls, 38 boys) and the second group — not involved high school students (30 girls, 30 boys).

## 3. RESULTS

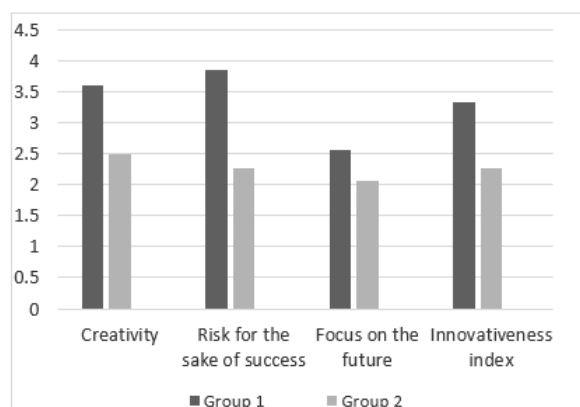
The separation of adolescents into groups was carried out through a questionnaire and survey; a questionnaire by N. V. Omelchenko for the study of the individual's gaming activity, experience and gaming genre preferences and a questionnaire to assess role-playing computer games engagement levels by E. V. Belovol and I. V. Petrova were used as methods (Belovol and Petrova, 2011; Luzakov and Omelchenko, 2012). The questionnaire included questions about whether the respondent has ever played computer games, his/her gaming preferences, time spent on the game, the features of game behavior, motivation of the subjects: with the help of the questionnaire the level of MMORPG involvement in the first group was studied. To statistically check differences in psychological characteristics of innovativeness and creativity of high school students involved and not involved in MMORPG, a nonparametric Mann-Whitney's U-test was applied.

**Table 1.** Results of comparative analysis of differences in all methods in the two groups (n=120)

	<b>The scale of methods</b>	<b>U emp.</b>
<b>Scale of self-assessment of innovative personality</b>	Creativity	<b>640**</b>
	Risk for success	<b>456**</b>
	Orientation towards future	<b>881.5**</b>
	Innovativeness index	<b>445.5**</b>
<b>The multidimensional questionnaire of individual innovativeness</b>	Risk for the sake of new achievements	<b>352.5**</b>
	Adaptability to change	<b>464**</b>
	Persistence	<b>263.5**</b>
	Independence	<b>933*</b>
	Positive attitude	<b>971.5*</b>
	Openness to something new	1229
	Intuition	1038.5
	Creative focus	1158.5
	Constructive leadership	<b>139**</b>
	Common indicator	<b>276**</b>
<b>Creativity</b>	Creative thinking	<b>534.5**</b>
	Curiosity	1176
	Originality	<b>363.5**</b>
	Imagination	<b>893.5**</b>
	Intuition	1119
	Emotional empathy	1111.5
	Sense of humor	<b>264**</b>
	Creative attitude to the profession	1117.5

Note: \* - significance level  $p < .05$ ; \*\* - significance level  $p < .01$

Analysis of data using “Scale of self-assessment of the person’s innovative traits” method by N. M. Lebedeva and A. N. Tatarko revealed differences in groups of high school students on all scales both in comparison of average values, and as a result of the non-parametric Mann-Whitney’s U-criterion use. A group of high school students involved in computer games showed better results on all the scales of the methodology (Table 1, Figure 1). Statistically significant differences were obtained at 0.01 level ( $p < .01$ ).

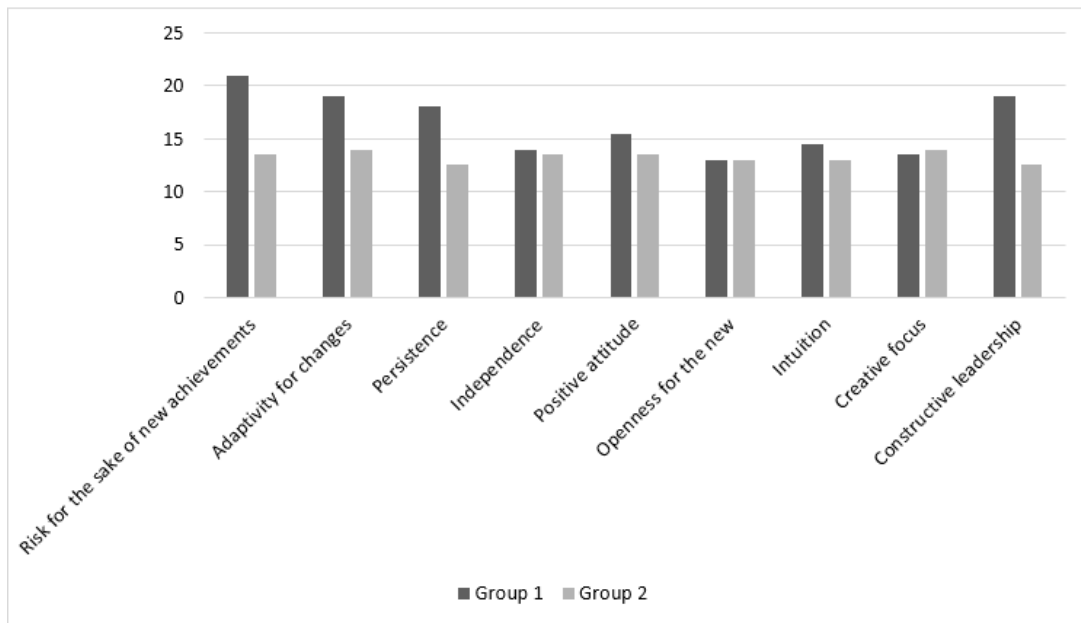


**Figure 1.** Results of differences (average values) on “Scale of self-assessment of the person’s innovative qualities” scales methodology (N. M. Lebedeva, A. N. Tatarko) (Group 1 – involved, Group 2 – not involved).

The results of research on MQPI method showed that there are statistically significant

differences at 0.01 level ( $p < .01$ ) on such indicators of innovativeness as *risk for the sake of new achievements, adaptability to changes, persistence, constructive leadership*, as well

as statistically significant differences by 0.05 ( $p < .05$ ) level on such characteristics as *independence and positivity* (Table 1, Figure 2).

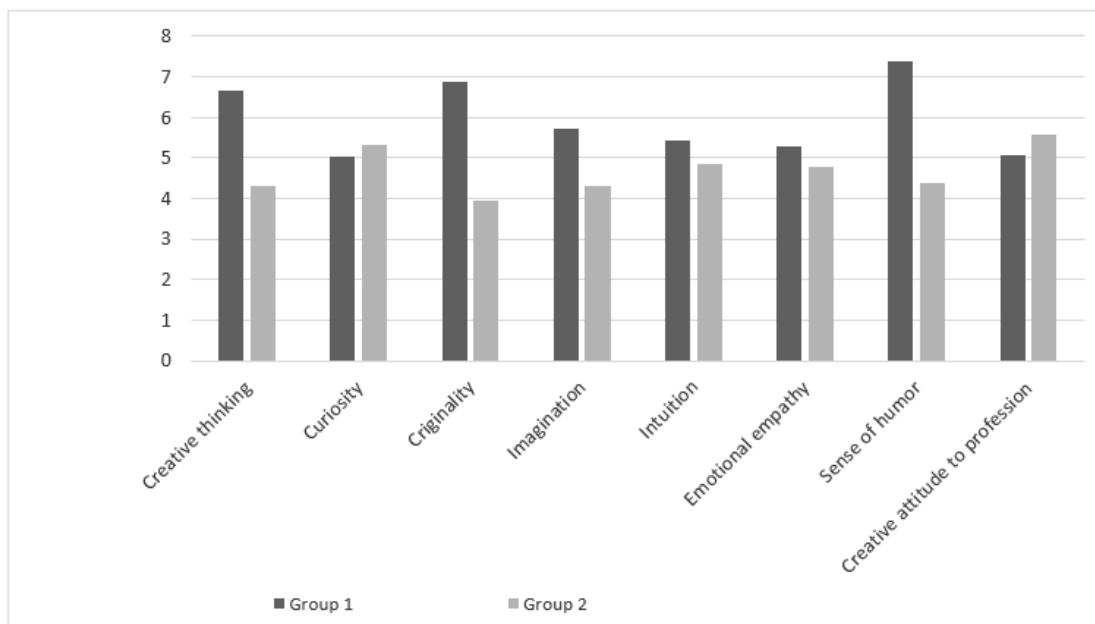


**Figure 2.** Results of differences (average values) on MQPI methodology scales (Group 1 —involved, Group 2 — not involved).

High school students who are passionate about MMORPG are characterized by greater adaptability to changes, ability to take risks, perseverance in comparison to their peers who are not involved in massively multiplayer on-line role-playing games.

The results of the study of differences by N. Vishnyakova's method "Creativity" showed

that there are statistically significant differences in the involved and non-involved sample by 0.01% ( $p < .01$ ) levels on such scales as *creative thinking, originality, imagination and sense of humor*, as the obtained empirical criterion indexes on them exceed the critical ones for a given number of subjects (Table 1 and Figure 3).



**Figure 3.** Comparative results of differences (average values) by the method of N. Vishnyakova "Creativity" (Group 1 – involved, Group 2 – not involved).

High school students involved in MMORPG at a statistically significant level ( $p < .01$ ) are characterized by higher rates on the scales of *originality, imagination and creative thinking* in comparison with the second group representatives (Table 1 and Figure 3). High school students involved in MMORPG have higher rates of sense of humor than students not involved in massive multiplayer online role-playing games. However, involvement in

MMORPG is not a marker that determines the high school students' manifestation of such components of creativity as *curiosity, intuition, emotional empathy and creative attitude to the profession*.

The results of the correlation analysis revealed a number of specific links in the manifestations of innovativeness and creativity in the representatives of both groups.

**Table 2.** The results of correlation analysis by the methods of MQPI and "Creativity" by N. Vishnyakova in groups with different levels of involvement (n=120)

Scales of the Multifactorial questionnaire of personality innovativeness	Groups 1 and 2	"Creativity" methodic scales							
		Creative thinking	Curiosity	Originality	Imagination	Intuition	Emotional empathy	Sense of humor	Creative attitude to profession
Risk for the sake of new achievements	Group 1	-.053	.111	.040	-.067	<b>.279*</b>	.056	.031	.046
	Group 2	.076	-.194	.103	-.020	.065	-.033	.133	.087
Independence	Group 1	.009	.071	.215	-.191	.038	.020	.016	.140
	Group 2	.075	-.002	.133	-.121	.095	-.017	<b>-.265*</b>	.055
Positive attitude	Group 1	-.007	<b>-.301*</b>	-.139	.154	-.058	.009	-.052	<b>.276*</b>
	Group 2	.074	-.107	.222	.129	.081	.062	-.191	.210
Openness to something new	Group 1	<b>.240*</b>	.060	.061	.046	.052	-.007	.179	.046
	Group 2	-.161	.191	-.095	.152	.120	-.131	-.028	.018
Intuition	Group 1	.028	.066	.078	-.207	.018	-.122	.028	<b>-.249*</b>
	Group 2	-.011	-.089	-.079	.019	.189	<b>.320*</b>	.065	.081
Creative focus	Group 1	.209	-.061	-.067	.109	<b>.283*</b>	.147	.041	-.146
	Group 2	-.026	.044	-.065	-.091	.025	.096	.187	.123
Constructive leadership	Group 1	.045	-.119	.111	.024	.004	<b>.312*</b>	.140	.016
	Group 2	.081	-.148	.091	-.092	-.119	.052	.138	.220

Note: \* - significance level  $p < .05$ . Group 1— involved, Group 2 — not involved.

The analysis of correlations between the scales of test methods of MQPI and "Creativity" revealed positive and negative significant relationships (Table 2).

The group of those involved is characterized by significant correlations between *risk for the sake of new achievements and intuition*. Perhaps these results are due to the specifics of the game plot, when the player needs to trust his feelings to make the right choice to achieve this goal. The second group of high school students showed a negative significant correlation between the scales of *independence and a sense of humor*. Independence of this group is perceived as a serious quality that does not cause positivity.

Let us consider the results between the "MQPI" method of innovation and the method

of self-assessment of innovative personality by N. M. Lebedeva and A. N. Tatarko, presented in Table 3.

**Table 3.** The results of the correlation analysis by the MQPI methods and the Scale of personality innovativeness self-assessment (N. M. Lebedeva, A. N. Tatarko) in groups with different levels of involvement (n=120)

MQPI method scales	Groups	« Scale of personality innovativeness self-assessment » (N. M. Lebedeva, A. N. Tatarko)		
		Creativity	Risk for the sake of success	Focus on the future
Risk for the sake of new achievements	Group 1	-.016	-.311*	-.054
	Group 2	.011	-.215	-.156
Persistence	Group 1	-.092	-.423**	-.243*
	Group 2	-.071	-.240*	-.190
Openness to everything new	Group 1	-.392**	-.084	-.111
	Group 2	-.171	.038	-.101

Note: \* - significance level  $p < .05$ ; \*\* – significance level  $p < .01$ . Group 1 – involved students, Group 2 – not involved.

Analysis of the results showed that the first group of respondents, in their manifestations of risk for the sake of success, does not associate success with new achievements, does not show perseverance, and is not focused on the future (Table 3). High school students involved in MMORPG show their potential abilities in the present time, in the process of gaming activities implementation. In the manifestations of creativity, they are not open to new things. It can be assumed that the specificity of gaming activity develops innovativeness, but does not focus on the implementation of potential opportunities in real life.

Let us consider the characteristics of creativity and self-assessment of the individual's innovativeness, obtained as a result of correlation analysis of data.

**Table 4.** The results of correlation analysis by the “Creativity” method by N. Vishnyakova and “Scale of personality innovativeness self-assessment” (N. M. Lebedeva, A. N. Tatarko) in groups with different levels of involvement (n=120)

“Creativity” method scales	Groups	“Scale of personality innovativeness self-assessment” method scales		
		Creativity	Risk for the sake of success	Focus on the future
Curiosity	Group 1	.360**	.289*	-.043
	Group 2	-.037	.083	.149
Intuition	Group 1	-.132	-.06	-.234
	Group 2	-.154	-.123	-.309*

Note: \* - significance level  $p < .05$ ; \*\* – significance level  $p < .01$

The analysis of the correlations between the scales of the two methods allowed to reveal positive and negative significant results on several scales. The first group representatives, in their manifestations of innovation and creativity, are quite inquisitive and willing to risk for the sake of success (Table 4), while the

second group representatives are not focused on the future in their intuition manifestations.

#### 4. DISCUSSION

The study showed that adolescents involved in MMORPG have a significant negative correlation between *positivity and curiosity*, as well as a significant positive correlation between *positivity and creative attitude to the profession*. Perhaps a group of high school students involved does not show positive emotions in the interest in the world, but this group is characterized by an optimistic attitude to the future of professional creativity. In addition, for the representatives of the first group, a positive correlation on the scales of *openness to new things and creative thinking is significant*. Perhaps this is due to the need for in-game research activities that develop creative thinking through quests, but it requires the player to be open to new information, knowledge and experience. Both groups of respondents expressed a manifestation of links with the scale of intuition. However, among those respondents involved in MMORPG intuition is aimed at creative attitude to the profession and creativity, while the representatives of the second group associate it with the emotional empathy manifestation. *Intuition* of the first group representatives is more focused on creativity and professional activity manifestation.

In addition, the first group of high school students demonstrates a significant positive correlation between the scales of *constructive leadership and emotional empathy*. Empathy expression is characteristic of both groups, but in the first group, empathy is associated with the characteristics of leadership, and for the representatives of the other group, empathy is intuitive and not purposeful.

For the participants of the game activity, the manifestations of success and creativity are important here and now, and they are not ready to realize their potential in the future. It should be noted that the second group of representatives also do not show persistence in risks for the sake of success. This tendency of passivity in the sample is probably due to a general reluctance to risk for success in the future.

The study showed that adolescents with a high level of involvement in massive multiplayer online role-playing games are characterized by the presence of statistically significant links between risk for the sake of new achievements and intuition, positivity and curiosity, positivity and creative attitude to

the profession, openness to new and creative thinking, intuition and creative attitude to the profession, creative orientation and intuition, constructive leadership and emotional empathy, risk for the sake of new achievements and risk for success, perseverance and risk for success, perseverance and focus on the future, openness to the new and creativity, curiosity and creativity, curiosity and risk for success.

High school students not involved in MMORPG are characterized by connections between independence and sense of humor, intuition and emotional empathy level, persistence and risk for success, intuition and focus on the future.

The results of the study revealed the following characteristics in the groups of respondents:

1. The group of high school students involved in MMORPG demonstrates higher rates of independence and positivity;

2. Involvement in MMORPG does not affect the high school students' formation of such indicators as innovativeness, openness to the new, intuition, creative orientation;

3. Representatives of the group involved in MMORPG are characterized by a more developed ability for constructive leadership and a higher level of innovation than their peers not involved in the massive multiplayer online role-playing games.

4. Those involved in computer games are characterized by higher originality, imagination and creative thinking than their peers from the second group, not playing massive multiplayer online role-playing games;

5. High school students involved in MMORPG have higher rates of sense of humor than the students not involved in massive multiplayer online role-playing games.

The gamers' subculture, like many other subcultures that arise and die according to the scenarios of new generations, is an artificial environment that forms social well-being in response to the lack of well-being in real life and activities. The saddest thing is that many new ideas born in virtual spaces and their ways of implementation remain not implemented in the real world. The most dangerous thing for humanity is that, lost in virtual worlds, homo sapiens may disappear as a species.

#### 5. CONCLUSION

The virtual world, absorbing human resources, challenges the modern man. Currently, it is important to use MMORPG stories

and technology as resources for the development of personal potential of modern generations. The activity of the subject acts as one of the criteria and regulatory mechanisms by which the activity is carried out. Preconditions of innovative activity and real expression of the person's innovative potential are different types of activity, including the virtual one (Mikhailova, 2016). Therefore, modern teachers, psychologists and game developers need to work together to find new stories for the use of virtual space for the benefit of personal development.

The author consider the personality potential as an integrative combination of inclinations, abilities, individual characteristics and personal qualities that provide the basis (foundations) for the implementation of human capabilities in various activities (Mikhailova and Kaminskaja, 2016; Mikhailova, 2018). Therefore, while providing psychological and pedagogical support of personal potential formation and development, it is important to use the virtual world game scenarios for the formation and implementation of personal opportunities in the creative objective reality (Stošić and Stošić, 2013; Stošić, 2015).

To solve these problems, we highlight several topical areas of psychological support for the personality development using MMORPG resources: 1) the introduction of virtual technologies into the practice of modern education, using the potential of MMORPG not as entertainment, but as a means of learning; 2) psycho-prophylaxis and psychohygiene of Internet addiction formation at the earliest stages of personality development; 3) the development of more realistic and creative game plots, strengthening the semantic moral value of the plot; 4) development of the practice of virtual and real group interaction in optimal combination; 5) implementation of jointly achieved results of active virtual activity in the creative environment of objective reality.

Cyberspace, created by man, was, is and will be an additional environment for society. If humanity does not learn to manage the virtual world, the virtual world will absorb human potential and make it work against the interests of the individual and in the interests of cyberspace. In order to avoid this, it is important to develop new technologies to support the formation of personal potential, to look for new ways of development of the modern personality activity, including the use of MMORPG plots and technologies, developing creative humans, not destroying them-

selves and the real world of harmony between wildlife and natural human relations.

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## Conflict of interests

The author declare no conflict of interest.

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# TOWARDS EMOTION RECOGNITION IN TEXTS – A SOUND-SYMBOLIC EXPERIMENT

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## ABSTRACT

The purpose of this study is to investigate the relationship between the phonetic content of prose texts in English and the emotion that the texts inspire, namely - the effect of vowel-consonant bi-phones on subjects' evaluation of positive or negative emotional valence when reading. The methodology is based on data from an experiment where the participants, native speakers of three different languages, evaluated the valence invoked in them by one-page texts from English books. The sub-lexical level of the texts was obtained using phonetic transcriptions of the words and their further decomposition into vowel-consonant bi-phones. The statistical investigation relies on density-measures of the investigated bi-phones over each text as a whole. The result shows that there exists a correlation between the obtained sub-lexical representation and the valence perceived by the readers. Concerning the type of the consonants in the bi-phones (abrupt or sonorant), the influence of the abrupt bi-phones is stronger. However, sub-sets of both types of bi-phones showed relatedness with the emotional valence conveyed by the texts. In conclusion, the speech, expressed in written form, is laden with emotional valence even when the words' lexicological meaning is not taken into consideration and the words are apprehended as mere phonetic constructs. This prompts hypothesizing that words' semantics itself is partly underpinned by some mental emotion-related level of conceptualization, influenced by sounds. For practical purposes, the result suggests that based on the syllabic content of a text it should be possible to predict the valence that the text would inspire in its readers.

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## 1. INTRODUCTION

Several studies have shown that speakers from different cultures detect similar emotional content solely with reference to speech flow even when the speech consists of pseudo-words (e.g. [Scherer, 2000](#); [Scherer et al., 2001](#)). In the present study, focusing on the relationship between emotions, language, and speech, I have assumed from such evidence that several aspects of the speech, including its phonetic content, display some basic, species-typical pattern that involves features related to emotion transfer. The line of reasoning followed herein questions the principle of arbitrary

ness proposed in the theory of linguistic signs ([De Saussure, 1916/1983](#)).

Defining the essential attributes, functions and substrates of emotion has shown itself to be a particularly elusive problem, and overall consensus thereto remains lacking ([Kleinginna and Kleinginna, 1981](#); [Russell, 2003](#); [Hamann, 2012](#) for overviews). There exist two main models of emotions used in machine emotion recognition – a discrete model of emotion categories and a continuous model of emotion dimensions (for a recent overview see [Burton, 2015](#)). The set of Emotion categories (such as anger, disgust, fear, happiness, sadness, and surprise), as proposed in the works of [Ekman, P. \(1999\)](#) and further enlarged, has become accepted by the greater scientific community and as a foundation for the development of contemporary emotion recognition systems. The other model of emotion portrays emotional phenomena according to their discernible attributes, considered as emotion-dimensions. Following this model (suggested by [Russell and Mehrabian, 1977](#)) emotions are usually described with three di-

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mensions - valence, arousal and dominance (VAD). Valence indicates whether emotions are pleasant (positive) or unpleasant (negative), arousal - the degree to which they are exciting or calming and dominance a rating of one's own status in relation to an emotion-causing occurrence. During the past few years, the VAD model has become intensively used in systems for emotion recognition as well as in the domain of sentiment analysis, prompting various efforts to bind dimensional models to emotional categories (e.g. [Buechel and Hahn, 2017](#)). However, the theoretical aspects regarding the brain mechanisms underlying the described formal models and the relation between them stay controversial.

In recent years, brain-imaging techniques have allowed the identifying of clear neural signatures that correspond to basic emotions. These patterns are involved deeply in the brain's typical multimodal fashion, exhibiting specific activations within a distributed network of cortical and subcortical areas (e.g., [Saarimäki et al., 2015](#)). In addition, questions regarding emotion dimensions and their correlates in terms of brain-functioning have been investigated. For example, [Maddock et al., \(2003\)](#) report fMRI evidence from a valence decision task showing the existence of specific brain regions activated only by unpleasant words and regions activated only by pleasant words. A recent study of brain-impaired subjects showed that both emotional valence and basic emotions are related to semantic memory, including for stimuli based on speech prosody ([Macoir et al., 2019](#)). Such results suggest that emotional valence is related to some semantic level of functioning of the human brain.

A matter of direct relevance to this study concerns emotional processing in relation to word recognition in reading. On the combined evidence of fMRI ([Marinkovic et al. 2003](#)) and event-related potential time-course studies (cf. [Abbassi, Kahlaoui et al. 2011](#), for a comprehensive review) it is known that, following initial recognition of visual features of words in the visual cortex, the resulting orthographic information is transmitted to auditory cortex and attributed its corresponding phonetic content. ([Van Orden, Johnston and Hale, 1988](#)). Recognition of lexical meaning proceeds largely in accord with processing of presented spoken word-sequences, that is – as perceived speech sounds.

There is mounting evidence that there exist non-arbitrary sound-symbolic patterns in language. One of the best-known examples

of systematic sound-symbolism and the first to be described ([Köhler, 1929](#)) is the correspondence of words predominantly consisting of abrupt consonants (e.g. t, k) with angular-shaped objects and words featuring sonorant consonants (e.g., m, l) with curvaceous objects. Subsequent research related to emotions ([Fantz and Miranda, 1975](#); [Leder, Tinio and Bar, 2011](#)) has demonstrated an inborn human emotional preference for curvaceous shapes.

During the last decade a huge amount of studies in sound-symbolism concentrate on the words' iconicity, a phenomenon considered as related mainly with the association between the sounds and the words' lexical meaning (e.g., [Imai and Kita, 2014](#); [Perlman, Dale and Lupyan, 2015](#), [Edmiston et al., 2018](#), [Winter et al., 2017](#); [Jones and Vigliocco, 2017](#), [Sidhu and Pexman, 2018](#) and many other works). The results of these numerous investigations confirm the relations between sound and meaning and propose that the phonetic content of the words could arise based on mechanisms related to perception, sensation, repeated imitation and so forth. These results suggest that sound-symbolic mechanisms have a general species-specific character. Indeed, in their recent experimental study, [D'Anselmo and colleagues \(D'Anselmo et al., 2019\)](#) did not find significant differences between Italian and Polish participants in guessing successfully the correct meaning of words in unknown languages. The authors conclude that there exist sound symbolic patterns that are independent of the mother tongue of the listener.

The connection between emotions and sound symbolic features also started to gain attention and led to results showing, for example, that taste and smell words form an affectively loaded part of the English lexicon ([Winter, 2016](#)).

The study of phonological effects on emotion has centered predominantly on poetry. The reasoning related to poetry originates from the Russian Formalists where the sound in poetry was first examined in a systematic fashion (for descriptions see [Trotsky, 1957](#); [Jakobson, 1960](#); [Shklovsky, 1990](#); [Mandelker, 1983](#)). Subsequent research, focusing on phoneme-level effects on experienced emotional state, has examined diverse examples of English poetry ranging from Byron to Beatles' song lyrics (see [Whissell, 1999](#)). Recent emotion-focused studies of German poetry undertaken by [Aryani, Ullrich, and colleagues \(Aryani et al., 2013](#); [Aryani et al., 2016](#); [Ullrich et al, 2017](#)) have also demonstrated the existence of a relation between the phonetic content of

poetic texts and the emotion that they convey.

The investigations of more general emotion-effects implicated in sound-symbolism have revealed important findings. Kawahara and Shinohara (2012), for example, conducted experiments, demonstrating a tripartite trans-modal symbolic relationship between three domains of cognition (auditory sounds, visual shapes, and emotions). A recent study by Adelman and colleagues (Adelman et al., 2018), based on data-analysis of corpora representing five languages of Europe, revealed the existence of strong correlations between, for example, abrupt initial-position phonemes and highly negative, arousing words as well as between slow onset initial phonemes and positive words. These recent studies concentrate on the general effect of single phonemes.

The idea that syllables represent basic compositional elements of speech is not new in linguistics (see, e.g., Itō, 2018). The rationale of consonant-vowel speech compositional sequences is incorporated in the written form of several languages, for example, Arabic. A syllabic structure is detectable, too, in sign-languages. For example, a recent study by Gökgöz (2018) revealed that Turkish sign-language has a syllabic composition. The syllables-emotion relation is acknowledged and used in speech-emotion recognition (e.g. Origlia et al., 2014). The role of syllables as emotional indicators was investigated, too, in terms of micro-prosody conveyed by syllabic pitch-profiles (Brandt and Bennett, 2015).

The study proposed here investigates the relation between the syllabic content of prose texts in the English language and the conveyed emotional valence with the hypothesis that such a relation exists.

## 2. MATERIALS AND METHODS

### 2.1. Goal and approach

The goal of the presented work is to explore statistically the relation between the vowel-consonant syllabic content of prose texts and the emotional valence that the text inspires in the readers in order to provide some phonological and statistical details of such relation, if it exists.

The used approach examines only the phonetic content of the word-sequences, without regard to their lexicological meaning, speech prosody, and other features of language that are commonly considered related to communicating emotion.

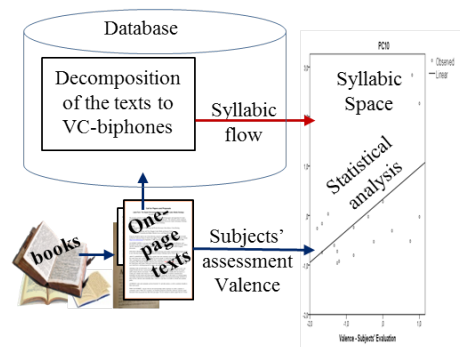
The study proposed here was inspired

by the analysis of the tripartite trans-modal symbolic relationship by Kawahara and Shinohara (2012). Their study was based on pseudo-words composed by two consonant-vowel syllables, organized in two types of phonological stimuli: “abrupt” (“Stop condition” - e.g. [tadi]) and “sonorant” (“Sonorant condition” - e.g. [maji]). The obtained result, based on auditory input of such pseudo-words, confirmed that English speakers associate oral stop consonants with angular shapes and showed that oral stops are associated with emotion types that involve abrupt onsets (e.g., “shocked” and “surprised”) and, too, that angular shapes are associated with those types of emotions that involve abrupt onsets. The study has led to the same kind of conclusions concerning the sonorant condition.

In the approach proposed in the present study, I supposed that features as “oral stop” and “oral passage” are clearly detectable in biphone syllables of the type vowel-consonant. The statistical treatment of the experimental data performed here is based solely on this syllabic scheme. Two forms of vowel-consonant biphones - vowel-abrupt (e.g., /ot/) and vowel-sonorant (e.g., /um/) were deployed. On the presumption that the emotional dimension of valence has a neuropsychological basis, I undertook an exploration of the relation between the English language, represented at vowel-consonant sub-lexical level, and emotional valence.

### 2.2. Experiment and data

In testing the hypothesis, the aim was to extract from textual data some metadata that is necessary for statistically investigating the presence of a relatedness of the phonetic characteristics of texts and the valence inspired in the readers. This was done based on experimental data, where the experiment was designed for this specific purpose (Figure 1).



**Figure 1.** General scheme of the study

The experiment was organized and conducted within a student’s project at the New Bulgarian University. Twenty approximately one-page-long passages of text were selected, each evoking a certain scenario that would predictably inspire a given emotional valence. The passages (hereafter called *experimental texts*) were taken from works by Leigh Bardugo, Charles Dickens, Neil Gaiman, Robin Hobb, Derek Landy, Brandon Sanderson, and J. R. R. Tolkien.

The participants in our experiment were residents of different countries, were native speakers of different languages (Arabic=2, Bulgarian=10, English=5), and all were highly proficient English language users. Their task was to evaluate each text overall and not its parts.

We submitted four texts (that we judged as different with regards of valence) to each participant to read silently and evaluate the valence of each. All participants received in written form the following instruction:

*“Many texts invoke certain emotions in the reader. For example, “A rose by any other name would smell as sweet” by Shakespeare invokes joy, positive emotion, while “As the light begins to intensify, so does my misery, and I wonder how it is possible to hurt so much when nothing is wrong” by Tabitha Suzuma – sadness, negative emotion. You will receive four texts in English. They are excerpts (a page long) from famous literary works, written by English natives. Evaluate what emotion is invoked in you by each of these texts by using this scale:*

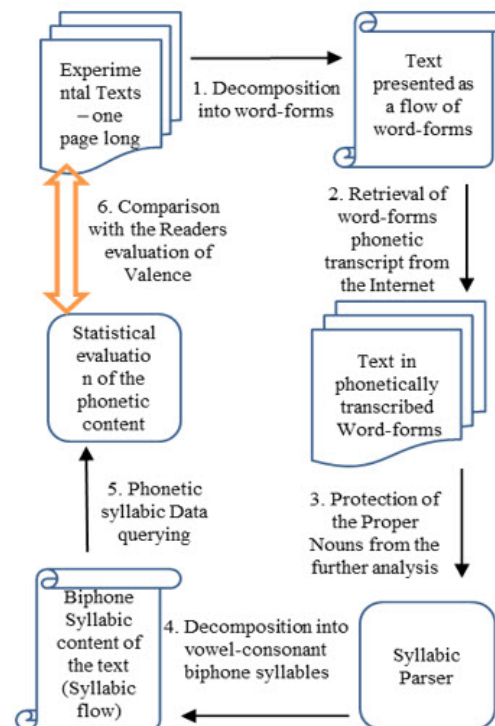
*Very negative, Negative, Does not arouse emotion, Positive, Very positive “*

The received written evaluations were assigned numeric marks from -2 (very negative) to +2 (very positive). The 20 texts were evaluated by the 17 participants, where each text was evaluated by at least 3 subjects (Max 6, Mean 4.7).

## 2.3. Phonetic representation and sub-lexical metadata

The textual data was stored in a database (see Figure 3) and further treated in order to extract its phonological characteristics as a stream of syllables. To perform the extraction of syllabic metadata from the raw text, 6 main steps were accomplished, as illustrated in Figure 2.

The sentences were first decomposed into word-forms. This step identified 10,692 word occurrences in the experimental texts. Next, the words’ phonetic transcriptions (following the commonly adopted IPA standard of English phonetic transcription) were downloaded from the Internet using online dictionaries. A number of words (about 2000) have necessitated a manual search. The dictionary of the transcribed words obtained after this step contains 5,767 phonetically transcribed words. The vocabulary used in the experimental texts contains 2,505 different English word-forms where 1,989 (79% of the used vocabulary) were represented with their transcription.



**Figure 2.** Stages of the treatment

Next, all word-occurrences which are proper nouns were retrieved and marked so as to not be included in the further analysis (see the sentence-example in Table 1). This step was necessary in order to exclude them from the emotion-related statistical picture, because

such words are not necessarily chosen by the writer and hence do not reflect her emotional state or intent. After this protective step, 153 occurrences of proper nouns were excluded. In total, 95% of the word occurrences in the experimental texts were subjected to further phonetic-decomposition and statistical treatment.

The next step was the syllabic decomposition of the transcripts. The approach proposed here is based on biphoneme syllables based on the entire set of phonemes in the English language. We took the set V of vowels (/æ/, /ɒ/, /ʌ/, /i:/, etc.) and the set C of consonants (/ŋ/, /d/, /k/, /f/, etc.) and composed the Cartesian product  $V \times C$  containing all possible biphoneme syllables of one vowel ( $v \in V$ ) as first element and one consonant ( $c \in C$ ) as a second element. Further, the biphoneme syllables obtained this way are called here “VC-biphonemes”.

The obtained Cartesian product, containing all 528 possible combinations of vowels and consonants, was stored in a separate table (Table “Syllables” in Figure 3) and used to decompose the phonetic transcription of words into VC-biphonemes when parsing. Parsing of the transcribed words showed that 267 out of the 528 VC-biphonemes are used in the experimental texts overall. In this way, the words’ phonetic transcriptions were presented as a VC-biphoneme sequence for each word and, consequently, a VC-biphoneme sequence for each text (see the example in Table 1).

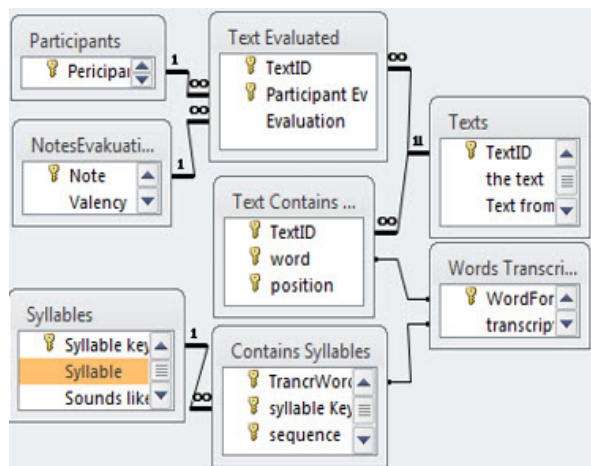
Further in this paper, I call a syllabic flow the phonological image of the experimental texts represented by means of VC-biphonemes, as shown in the example provided in Table 1. For the phonological analysis, with regards of the results reported by Kawahara and Shinohara (2012), the VC-biphonemes were divided into “abrupt” subset (/ɑ:ð/, /ɒdʒ/, /æb/, /aʊtʃ/, etc.) and “sonorant” subset (/ɑ:m/, /ɒn/, /ɔ:r/, /əʊl/, /əw/, etc.) following their consonant (voiced or unvoiced).

**Table 1.** Example of decomposition of the sentence “Sarene stepped off of the ship to discover that she was a widow.” into VC-biphonemes – a query result.

Word	po- si- tion	Phonetic transcript	Syllabic flow	se- quence
Sarene	1	@Sarene		
stepped	2	stept	<b>ep</b>	1
off	3	ɒf	<b>ɒf</b>	1
of	4	əv	<b>əv</b>	1
the	5	'ðə		
ship	6	ʃɪp	<b>yp</b>	1
to	7	'tu:		
discover	8	dɪskʌvər	<b>ys</b>	1
discover	8	dɪskʌvər	<b>ʌv</b>	2
discover	8	dɪskʌvər	<b>ər</b>	3
that	9	ðæt	<b>æt</b>	1
she	10	'ʃi:		
was	11	wɒz	<b>ɒz</b>	1
a	12	'eɪ		
widow		wɪdɒw	<b>yd</b>	1

It should be noted that the particularities of standard notation used in the transcripts led to naming the phoneme /ɪ/ (as per e.g. /ɪt/ in [ˈbenɪfɪt]) to /y/ because the upper case of the letter i used to denote the phoneme is undistinguishable from its lower case (as per, e.g., /ɪt/ in [rɪt]) by the used data-treatment product.

As the statistical treatment was based on results of counting queries, it was important to protect the calculations from erroneous data-fusion, and the data was organized in a relational database in 3<sup>th</sup> Normal Form with referential integrity (Figure 3). This means of structuring the data allowed performing the obligatory step of data-verification based on a comprehensible text-decomposition as shown in Table 1, and thereupon, to perform counting queries.



**Figure 3.** Data Base - organization of the data for the treatment

The analysis showed that the 20 experimental texts were containing on average 534 words (min. 207, max. 1016). The overall number of VC-biphones detected in the experimental texts is 9,275 where 4,624 are abrupt and nearly the same number – 4,651, are sonorant. The phonetic density of the examined feature seen as percentage of VC-biphones over the total number of words is quite low – 90%, that is – on average, one word contains less than one VC-biphone.

### 3. RESULTS

#### 3.1. Correlation between emotional valence and the volume of abrupt syllables

To evaluate the content of each experimental text in terms of participation of abrupt and sonorant VC-biphones in the syllabic flow, the following measure for the Texts' Syllabic Charge (TSC) was applied:

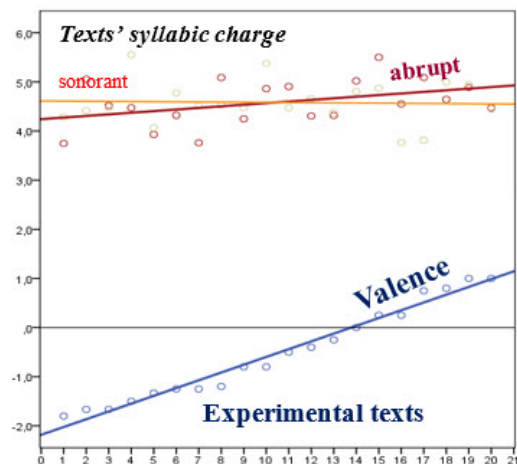
$$(1) \quad TSC_{STj} = \frac{NSyll_{STj}}{NWord_j}$$

where the index ST denotes the type of the VC-biphones – abrupt or sonorant, NSyll<sub>STj</sub> shows the number of VC-biphones of type ST that appear in the experimental text j, NWord<sub>j</sub> is the number of transcribed words in the experimental text j (j = 1 to 20). The texts syllabic charge shows the extent of involvement of abrupt or of sonorant VC-biphones in the syllabic flow in a given experimental text.

This measure revealed that the used textual data cannot provide a reliable statistical picture for the texts' charge regarding the so-

norant VC-biphones and their correlation with valence (Pearson's  $r = -0.06$ ,  $p < 0.8$ ).

The text syllabic charge ensuing from abrupt VC-biphones led to much more reliable statistics, indicating relatedness between the volume of abrupt VC-biphones and Valence ( $r = 0.416$ ,  $p < 0.068$ ). This indicates that at least some subset of abrupt VC-biphones has influenced the readers' emotional judgment. The plot in Figure 4 illustrates this tendency.



**Figure 4.** Texts' Valence and Syllabic Charge of abrupt and sonorant VC-biphones

The displayed result is not statistically unquestionable, but nevertheless indicates a particular tendency. This fact prompted two hypotheses: 1. The experimental texts are too short to contain a sufficient volume of VC-biphones; 2. The split of the VC-biphones into abrupt and sonorant sub-sets does not lead to a clear-cut statistical picture. The next step was to investigate the influence of each of the syllables separately, independently of their abruptness.

#### 3.2. Connection between emotional valence and the set of VC-biphones

To evaluate the degree of involvement of each of the VC-biphones in the syllabic flow pertaining to each of the experimental texts, a Syllabic Ratio per Document (*RatSyll*) of each of the 267 biphones appearing in the texts was calculated using the equation:

$$(2) \quad RatSyll_{ij} = k \cdot \frac{NSyll_{ij}}{NWord_j \cdot NSyll_j}$$

where  $NSyll_{ij}$  shows how many times the VC-biphone  $i$  ( $i=1$  to 267) appears in the

experimental text  $j$ ,  $NWord_j$  is the number of transcribed words in the experimental text  $j$  ( $j = 1$  to 20) and  $NSyll_j$  is the number of VC-biphones in the syllabic flow of the experimental text  $j$ . As the Syllabic Ratios obtain very small values, for reasons related to the perceptibility of the metadata, they were multiplied by  $k=10^6$ . The Syllabic Ratio per Document shows the extent of involvement of a given VC-biphone in the syllabic flow of a particular experimental text.

The correlation analysis of the interdependency between the Valence-score and the Ratios of the VC-biphones showed that the investigated textual data provides a reliable statistical result ( $p$ -value  $< 0.09$ ) for the 13 VC-biphones listed in Table 2. As it can be observed, only two of these VC-biphones are from the sonorant subset. Some of the investigated VC-biphones display a high and reliable correlation between them, because, in general, the words in the language have several compositional rules to respect.

**Table 2.** Pronounced Correlation of separate VC-biphones with the Valence score

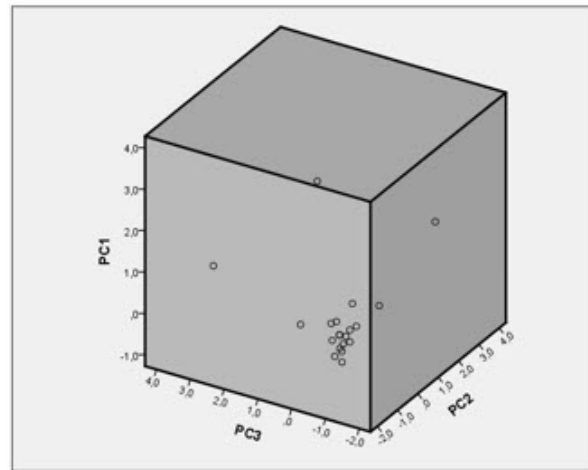
VC-biphone	correlation with Valence	p-value	type
ut	0.615	0.0039	abrupt
ys	0.552	0.0116	abrupt
æv	0.489	0.0286	abrupt
yk	0.487	0.0293	abrupt
əs	0.487	0.0295	abrupt
ert	0.464	0.0392	abrupt
ydʒ	0.422	0.0636	abrupt
eɪp	0.414	0.0693	abrupt
u:t	0.405	0.0768	abrupt
ɜ:n	0.389	0.0900	Sonorant
u:l	-0.413	0.0702	Sonorant
i:θ	-0.473	0.0353	abrupt
eɪs	-0.500	0.0248	abrupt

As, due to the nature of the language system itself, the phonemes in the speech are correlated between them, in order to detect a comprehensive statistical picture, a dimension reduction using principal component analysis (PCA) was performed.

The 20 experimental texts were presented in a 267-dimensional statistical space in which each document is depicted by the Syllabic Ratios derived from its corresponding syllabic flow. The initial 267-dimensional

space was reduced (having eigenvalues  $> 1$ , where 99% of the variance was extracted) to 18 principal components (PCs).

This reduced space expresses features which are discriminative for the 20 experimental texts and are derived from their syllabic flows. It should be noted that, due to the rather limited amount of textual data, some of the VC-biphones have been excluded from the analysis as they occur only a few times in the textual data and/or occur with zero variance in the set of experimental documents. The number VC-biphones which syllabic ratios were submitted to PCA is 174. The coordinates of the experimental texts were recalculated in the obtained 18-dimensional space, called hereafter a *PC Syllabic space*. Figure 5 shows the experimental texts presented on the first 3 PCs.



**Figure 5.** The 20 experimental texts, presented in the PC Syllabic space (the first 3 PCs).

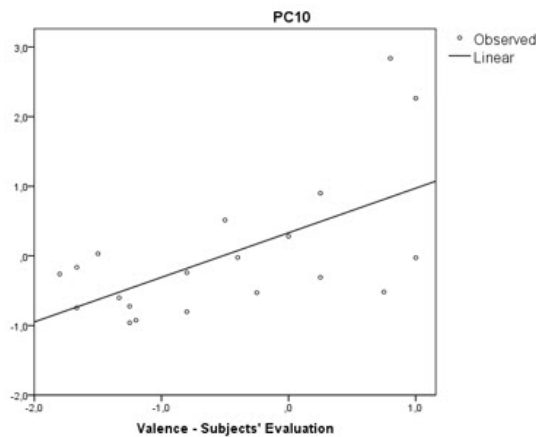
The relationship between emotional valence and the phonetic features expressed by the PC Syllabic space were investigated in terms of correlation between the valence-scores of the 20 texts and the 20 coordinates of these texts on the 18 axes (the PCs) of the PC Syllabic space.

The correlation analysis revealed that one of the PCs displays a reliable and important correlation with valence. (PC#10: Pearson's  $r = 0.607$ ,  $p < 0.005$ ). The plot of the linear regression of this PC on Valence is shown in Figure 6. No other PCs displayed a reliable and important correlation with valence.

This result suggests that there exist a relationship between the VC-biphone content of a text and the emotional valence that the text inspires in the reader.

Next, a check was conducted to ascer-

tain whether the abrupt VC-biphones had some more important impact on the obtained valence-related PC (seen as expressing text-discriminative biphonic feature) as such an impact was suggested by the correlation of the texts syllabic charge reported in section 3.1.

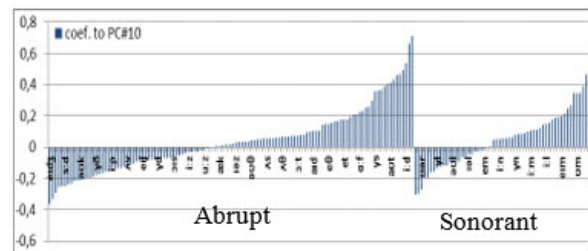


**Figure 6.** Interdependency between the valence-scores of the texts and their phonetic metadata.

### 3.3. Impact of the abrupt and sonorant VC-biphones

The further step was to investigate separately the impact of abrupt and sonorant VC-biphones on valence using the coefficients in the PCA transition matrix. The assumption was that the PC which shows a high correlation with the valence-score expresses some “summarized” and independent feature present in the syllabic flow which is important for inspiring valence.

The total number of VC-biphones that are projected on the valence-correlated PC is 174 where 118 are a subset of the abrupt VC-biphones and only 56 – a subset of the sonorant VC-biphones. The plot of the values of their corresponding transition coefficients is given in Figure 7. As it is seen, both types of VC-biphones are projected with both - positive and negative transition coefficients. It is also seen that the subset of abrupt VC-biphones has a stronger effect and that their effect is mostly in positive direction, confirming the result reported in section 3.1. The subset of sonorant VC-biphones has a smaller effect on valence, but, scientifically, this effect cannot be dismissed. The list of the first 10 “more negatively” and “more positively” projected VC-biphones of both types is provided in Table 3.



**Figure 7.** Plot of the influence of the VC-biphones on the valence-correlated PC, expressed by means of their coefficients in the component transition matrix.

It can be seen in Table 3 that the VC-biphones /eip/ and /yk/ (/Ik/), positively projected on the valence-correlated PC, are between the listed in Table 2 VC-biphones which, even in the small amount of textual data used in the experiment, displayed, each of them separately, a reliable positive correlation with valence.

As indicated by the extracted metadata, the vowels included in the VC-biphones do not represent a factor which seems related with the inspired valence. For example, as seen in Table 3, the vowel /e/ appears in the abrupt /eip/ and in the sonorant /eim/ VC-biphones, which have a positive influence and, the same vowel /e/ appears in abrupt /eidz/ and in the sonorant /eil/, which have a negative influence.

The same type of contradictory inclusion of vowels can be observed in Table 2 for the vowel /u:/ which is included in VC-biphones displaying both - negative and positive correlation with valence. Such observations suggest that an eventual detailed analysis has to take into consideration more specific phonological features of the vowels.

**Table 3.** The VC-biphones assigned with the ten top positive and negative coefficients by PCA.

Abrupt	coef.	Sonorant	coef.
ep	0.709	ɑ:n	0.467
ɒb	0.660	ɔ:l	0.390
i:d	0.535	ɜ:n	0.347
ɑ:ð	0.492	ʊm	0.345
ɒf	0.464	aʊn	0.343
yk	0.458	aɪl	0.267
əʊz	0.434	ər	0.249
aʊt	0.408	u:n	0.213
əb	0.397	eɪm	0.200
ʊd	0.392	ɪŋ	0.193
eɪdʒ	-0.364	ʌŋ	-0.305
ef	-0.333	ɑ:r	-0.297
əp	-0.291	ʊər	-0.272
ɑ:s	-0.256	ɒŋ	-0.196
ɪv	-0.251	ɒm	-0.194
ɜ:d	-0.249	æn	-0.163
i:tʃ	-0.237	eər	-0.159
ep	-0.236	ɪl	-0.133
ɪp	-0.219	ʊl	-0.126
i:θ	-0.213	eɪl	-0.120

## 4. DISCUSSION

### 4.1. Next steps to be performed

The analysis proposed here is based on a subset of syllables which density in the texts is quite low. The step to be performed using the same method is to include in the syllabic flow the consonant-vowel biphones and to investigate a greater amount of valence-evaluated textual data.

The selection of valence-relevant texts represents a concern because they have to be long enough in order to contain a representative subset of syllables and, at the same time, the content of each must be such as to evoke, in an overall homogenous way, a similar rating of valence in readers. This problem can be solved using existing corpora of emotionally evaluated texts combined with convenient strategies for assembling valence-homogenous data-sources with appropriate volume.

## 4.2. General discussion

From the result presented here, it is not possible to explain the principle by which the observed phonetically accomplished transmitting of emotion-encoding information enters and exerts its emotional effect on a text's lexical substance. To my knowledge, there is no ready-to-hand explanation of the phenomenon described here. The key questions awaiting scientific explanation are: 1. how did words come to incorporate these sound-patterns and 2. to what extent the observed patterns are language-dependent? The parts of such puzzle are far from being assembled. Comparative studies of more languages could identify some general language-independent features. Key to the puzzle is to understand the manner in which humans construct their semantic representations.

The result of this study prompts the hypothesis that concept's semantics itself is partly underpinned by some emotion-related level of representing phenomena, rooted in the long evolutionary development of animal species, while phenomenal iconicity and sound symbolism are instrumental for its overt, verbally framed expression as human speech.

## 5. CONCLUSION

The statistical result shows that there exists emotion-related information incorporated in the VC-biphone content of the English language. Thus, the speech is laden with emotional meaning even when the words' lexicological meaning is not taken into consideration and the words are apprehended as mere phonetic constructs. The study's general conclusion is that the syllabic composition of the words is not arbitrary from the standpoint of valence.

The result suggests that phonological characteristics prevailing within a syllabic flow should make it possible to predict the valence that a given text would inspire in its readers. In other words, the features of the syllabic flow could be useful for valence-classification of texts.

However, the statistical parameters of the proposed analysis suggest that the concrete details of the revealed interdependency can be correctly assessed using experimental data of larger volume.

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### Conflict of interests

The author declares no conflict of interest.

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# LOOKING WITHOUT SEEING: THE ROLE OF METACOGNITIVE BLINDNESS OF STUDENT WITH HIGH MATH ANXIETY

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*anomalous result.*

## ABSTRACT

This study aims to reveal how metacognitive failure occurs during problem-solving experienced by the pre-service teacher with mathematics anxiety. The data collected are in the form of words obtained through interviews, pictures of the results of the subject's work, and the results of the mathematics anxiety questionnaire as an instrument for selecting subjects. Description of data analysis and interpretation of the meaning of the findings apply text analysis. Analysis is conducted in all phases of problem-solving including the phase of understanding, analyzing, exploring, planning, implementing, and verifying. The presence of metacognitive blindness is identified through red flag, which is a warning sign to stop or retreat to the previous problem-solving phase and immediately take certain actions. Three types of red flag identified in this study include lack of progress (LP), error detection (ED), and anomalous results (AR). The results of the analysis show that students who experience math anxiety can experience metacognitive blindness during the problem-solving process. Red flag, which is dominant in metacognitive blindness, is error detection. This red flag occurs because subjects with mathematics anxiety pay less attention to the details of the problem, so they miss a lot of important information. The subjects see the problem only on the surface, based on the words they read in the problem presented.

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## 1. INTRODUCTION

Students will internalize what and how their teachers teach, meaning that if they sense that their instructors do not enjoy being

in the classroom, they will be less motivated to participate and learn (Jackson and Leffingwell, 1999). However, pre-service teachers' negative memories of their primary years can have a lasting effect, potentially up to 20 years or more when they serve as teachers. Based on the literature, pre-service teachers could perpetuate the negative cycle of mathematics anxiety in their students because of their own internal reaction to mathematics (Jackson and Leffingwell, 1999). Therefore, becoming aware of the prevalence of mathematics anxiety can be a vital step in providing a positive outcome towards mathematical performance in future generations.

Mathematics anxiety is the main factor

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that inhibits success in mathematical problem-solving (Güven and Cabakcor, 2013). Other studies have found that high levels of mathematics anxiety are associated with less efficient mathematical problem-solving (Hoffman, 2010).

The negative effects of mathematics anxiety on the success of mathematical problem-solving have been investigated by some experts (Carey, Hill, Devine, and Szücs, 2016). This is not surprising since problem-solving is at the core of mathematics learning (Cai and Lester, 2010). However, until now no research has been able to explain how this mechanism of mathematics anxiety interferes with the problem-solving process. In fact, information about this is needed for students who experience mathematics anxiety to improve their learning methods.

Problem-solving activity, one form of high-level thinking is closely related to metacognition (Faradiba, Sadijah, Parta and Rahardjo, 2019). The process of problem-solving is not enough if a student only has a lot of mathematical knowledge and facts, but must be accompanied with the ability to monitor and regulate the knowledge he/she has (Garofalo and Lester, 1985). This is in line with the framework of cognition-metacognition in problem-solving (Artz and Armour-Thomas, 1992).

Unfortunately, the metacognitive process cannot always go well. This is because the knowledge that is already owned cannot always be used optimally. Hoorfar and Taleb (2015) mention that mathematics anxiety makes students unable to use all of their metacognitive knowledge optimally. Another study identifies three types of metacognitive failures that are displayed by problem solvers as a reaction to red flag, namely metacognitive blindness, vandalism, and mirage (Goos, 2002).

In particular, there are two types of blindness when associated with attention (*inattentional blindness*), namely functional blindness and sighted blindness (Mack and Rock, 1998). Functional blindness is an activity of looking without seeing. This experience is most likely to occur when the subject lacks concentration and sensitivity to the condition of the environment. Conversely, sighted blindness occurs when the subject is involved in a very interesting conversation or when the subject is doing deep thoughts about something. This encourages the subject to look at things in more detail than others and pay more attention to things that are not really necessary.

The purpose of this study was to find out how metacognitive blindness occurs in pre-service teachers who experience mathematics anxiety. The results of this study are expected to provide input for the development of a mathematical learning model, considering that pre-service teachers have a very vital role in the success of future learning.

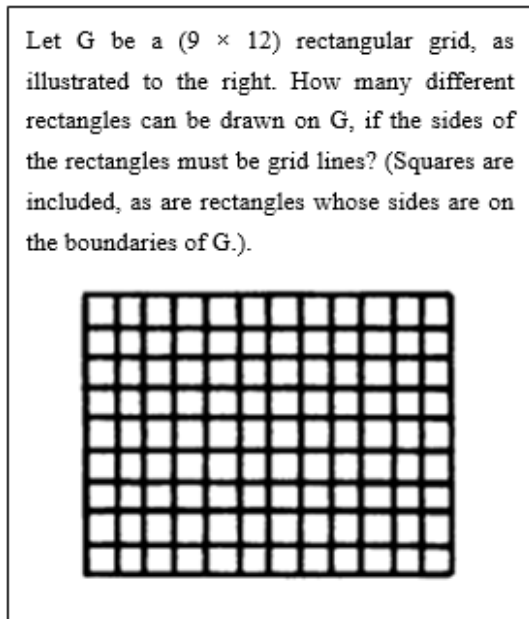
## 2. MATERIALS AND METHODS

This research applied qualitative approach with a case study design. The researcher ensured that the students had passed the Theory of Numbers course. This consideration is important to make sure that the prospective subjects have sufficient cognitive knowledge to solve the mathematical problems investigated in this study.

The mathematics anxiety score used in this study was adapted from MARS-R (Plake and Parker, 1982) and translated into Indonesian language. This instrument consists of 24 questions and given a score from 1 to 5 (1 shows no anxiety to 5 shows high anxiety). The items of the questionnaire were categorized into two factors. The first is anxiety factor that occurs when learning mathematics comprising of items that measure anxiety experienced during activities related to learning mathematics. The second is anxiety during the mathematics exam containing 8 items that measure the experience of anxiety when working on exam/test questions.

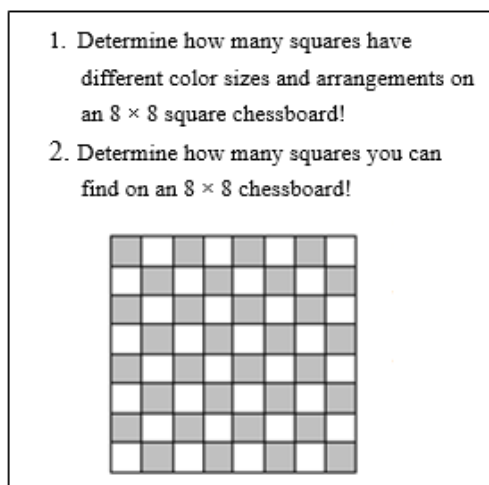
At this phase, two prospective subjects who had the highest math anxiety score were selected. The first subject (S1) got 70 in the first factor in mathematics anxiety score (considered high category) and 25 (considered moderate category) in the second factor. Therefore, it can be concluded that the source of anxiety experienced by the S1 was on the first factor. Meanwhile, the second subject (S2) got 48 in the first factor (considered moderate category) and 36 in the second factor (considered high category). Consequently, it can be said that the second factor was the main source of anxiety experienced by the S2.

The mathematical problem used in this study was adapted from Schoenfeld (1985). The initial problem presented by Schoenfeld is presented in Figure 1. Meanwhile, the problems, which are the results of adaptation used in this study, are presented in Figure 2.



**Figure 1.** Mathematical Problem-Solving

There were several considerations in adapting mathematical problems. The first is the subject's background in the previous education level. Not all subjects have a mathematical background at high school level; some come from social sciences and linguistics. Therefore, the mathematical problem was simplified from a rectangle measuring  $9 \times 12$  square units to a square measuring  $8 \times 8$  square units. Because the sides of the square have the same size, it was expected to make it easier for the subjects to solve this mathematical problem. The second was by adding a different color to the square size of  $8 \times 8$ . This was done to attract the attention of the subject in order to give enough attention to solve this problem.



**Figure 2.** Adapted Mathematical Problem-Solving in this Research

The subjects then were asked to complete the problem-solving on a piece of paper. Next, an analysis was conducted based on the results of the students' work to determine whether the subjects could potentially experience red flag and metacognitive blindness during problem-solving process based on the description of metacognitive blindness in Table 1 to Table 6.

Table 1 describes metacognitive blindness which is caused by three types of *red flags*, namely *lack of progress* (LP), *error detection* (ED), and *anomalous results* (AR) that occurred in the process of understanding problem. The activity of understanding the problem is the activity to determine what is asked and to identify the information contained in the problem.

**Table 1.** Indicators of Metacognitive Blindness at the Phase of Understanding Problems

Red flag	Indicators of Metacognitive Blindness Types
LP1	The subjects do not realize that they have difficulty in determining what is asked.
ED1	The subjects do not realize that they made a mistake in the process of determining what is asked.
AR1	The subjects do not realize that the error/incongruity they find in solving the problem actually does not exist.

Furthermore, Table 2 contains a description of metacognitive blindness caused by *red flag* when the subjects analyze the problem. Analyzing the problem is the activity of thinking about material related to the problem and connecting the material with what is asked in the problem.

**Table 2.** Indicators of Metacognitive Blindness at the Phase of Analyzing Problems

Red flag Types	Indicators of Metacognitive Blindness
LP2	The subjects do not realize that they have difficulty in determining the relationship between what is known and what is asked.
ED2	The subjects do not realize that they make a mistake in the process of determining the relationship between what is known and what is asked in solving the problem.
AR2	The subjects do not realize that the error/incongruity that they find in the process of determining the relationship between what is known and what is asked in solving the problem actually does not exist.

Table 3 contains a description of metacognitive blindness caused by *red flag* when the subjects explore the problem. The activities in this phase are activities using relevant information from the previous two phases.

**Table 3.** Indicators of Metacognitive Blindness at the Phase of Exploring Problems

Red flag Types	Indicators of Metacognitive Blindness
LP3	The subjects do not realize that they have difficulty in determining information that is relevant to the method used.
ED3	The subjects do not realize that they make a mistake in the process of determining information that is relevant to the method used.
AR3	The subjects do not realize that the error/incongruity that they find in the process of determining relevant information in the way it is actually used does not exist.

After the phase of exploring the problem, the subjects then plan to solve the prob-

lem. At this phase, the subjects think of an approach that can be used to find a solution. Indicators of metacognitive blindness at this phase can be seen in Table 4.

**Table 4.** Indicators of Metacognitive Blindness at the Planning Phase for Problem-Solving

Red flag Types	Indicators of Metacognitive Blindness
LP4	The subjects do not realize that they have difficulty in determining various approaches to solve the problems.
ED4	The subjects do not realize that they made a mistake in the process of determining various approaches to solve the problem.
AR4	The subjects do not realize that the errors/incongruities that they found in the process of determining various approaches to solve the problem actually do not exist

In the fifth phase, the subjects carry out a problem-solving plan. Here the subjects apply the chosen approach and combine several approaches. Indicators of metacognitive blindness at this phase can be seen in Table 5.

**Table 5.** Indicators of Metacognitive Blindness at the Phase of Implementing a Problem-Solving Plan

Red flag Types	Indicators of Metacognitive Blindness
LP5	The subjects do not realize that they have difficulty in determining the steps of implementing the chosen strategy.
ED5	The subjects do not realize that they make a mistake in the process of determining the steps of implementing the chosen strategy.
AR5	The subjects do not realize that the error/incongruity they find in the process of determining the steps for implementing the chosen strategy is actually nonexistent.

The final phase is verification. At this phase, the subjects evaluate activities related to approaches, methods, strategies, calculation procedures and the final results. Indicators of metacognitive blindness at this phase

is in Table 6.

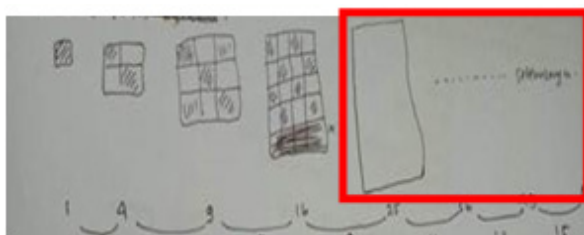
**Table 6.** Indicators of Metacognitive Blindness at the Verification Phase

Red flag Types	Indicators of Metacognitive Blindness
LP6	The subjects do not realize that they have difficulty in the process of checking the suitability of the solution that has been produced.
ED6	The subjects do not realize that they made a mistake in the process of checking the suitability of the solution that has been produced.
AR6	The subjects do not realize that the error/incongruity they found in the process of checking the real solution does not exist.

### 3. RESULTS

#### 3.1. Description of the Problem-Solving Process by Subject 1 (S1)

S1 described a square size of  $1 \times 1$  by means of shading. In this case, shading represents a square on a black chess board. Whereas it can be seen on the chess board that there is also a white square besides the black square. Therefore, it can be concluded that the information collected by S1 at the phase of understanding the problem is incomplete. The results of the S1 work for the first problem is shown in Figure 3.



**Figure 3.** The Mathematics Anxiety Indicator Experienced by S1 in Resolving Problem 1

S1 also had difficulty in determining what was actually asked in the first problem. *Red flag* that occurs in this phase is ED1. This can be seen when S1 calculated the number of squares in each picture he made that is actually not asked in the problem. This is indicated

by the numbers written at the bottom of each square made by S1. In square size  $1 \times 1$ , it is written 1 showing that the number of square units in square size  $1 \times 1$  is 1. In square size  $2 \times 2$ , it is written number 4 indicating that the square size  $2 \times 2$  is formed from 4 square units. In square size  $3 \times 3$ , S1 wrote number 9, indicating that square size  $3 \times 3$  is formed by 9 square units. Finally, at the bottom of the square the size of  $4 \times 4$ , S1 wrote number 16, meaning that there are 16 square units forming a square size of  $4 \times 4$ . For a square size of  $5 \times 5$ , S1 did not make the picture sketch. Sketching for a  $5 \times 5$  square is avoided by the S1 because he felt anxious about the results of the sketches that did not form a square, but rather a rectangle. This was shown in the dialogue between I(7) and S1(8). However, he started to understand the pattern of the number of square unit from the four squares he made earlier that is 1, 4, 9, 16; therefore, S1 continued this pattern to be 1, 4, 9, 16, 25, 36, 49 and so forth.

The difficulties in identifying what is asked in solving problems done by S1 is supported by the results of the following interviews between interviewer (I) and subject 1 (S1).

I(1): "What do these numbers mean?" (Pointing to the number written below the picture)

S1(2): "These numbers show the number of unit squares in each of the square above it."

I(3): "So, how many different squares are there on the chess board?"

S1(4): "Because the chess board is  $8 \times 8$  square unit, the number of squares is 64."

I(5): "Are you sure that is what is asked in this problem?"

S1(6): "yes"

I(7): "What about the  $5 \times 5$  of a chess board? Why did not you make a sketch?"

S1(8): "I am not sure with the sketch I made because the shape is no longer square, but a rectangle"

Dialogues I(3) to S1(6) indicate that S1 failed in determining what was asked in solving problems, but he did not realize it and felt confident in the answer. In this case, S1 only saw that the chess board has 64 square units. However, S1 could not realize that the first problem asked about how many different squares. The word *different* means square color differences on chess board (black and white) and different square sizes that might be

formed from a chess board. S1 only glanced at it and did not observe well the illustrations given on the first problem.

In the phase of analyzing problem, S1 also experienced *red flag* when identifying material related to problem-solving. *Red flag* that occurred at this phase is LP2. S1 only mentioned one material about the concept of square. This is shown from dialogues I(9) until S1(14) of the interview transcription as follows.

I (9): "What material is related to solving this problem?"

S1(10): "Square Concept"

I (11): "Can you explain more specifically what kind of square concept do you mean?"

S1(12): "Square has 4 equal sides. because the unit in solving this problem is using a unit square, a square can be formed from a square arrangement of units that has a size of  $1 \times 1$ ,  $2 \times 2$  and so on to  $8 \times 8$ ."

I (13): "Besides the concept of square, is there any other material related to solving this problem?"

S1(14): "there is no"

The next phase is exploring the problem; S1 experienced LP3 in gathering information that is relevant to the strategies used in problem-solving. This can be seen from the failure of S1 to identify color differences on the chess board. This can be seen in Figure 3 showing that S1 showed only a black (shaded)  $1 \times 1$  chess board. S1 ignored the white  $1 \times 1$  square, which is actually also on the chess board.

The fourth phase is planning problem-solving. At this phase, *red flag* that occurs is shown by the presence LP4. It occurs when S1 determined the right strategy to solve problem-solving. Actually, there are three strategies can be used: using the formula for the number of  $n$  terms in a series, using a pattern, and counting directly through drawing sketches. However, to solve problem number 1, a combination of strategies is needed. S1 did not realize that the strategy he chose must be combined to produce the correct solution.

In the fifth phase, implementing a problem-solving plan, S1 experienced AR5. S1 only used one last strategy – using a pattern. Sketching images made by S1 only served as a basis for making patterns. However, after the pattern appeared, the sketch of the image was not used anymore. This can be seen in Figure 3 showing that S1 only sketched images for

square size  $1 \times 1$ ,  $2 \times 2$ ,  $3 \times 3$ , and  $4 \times 4$ . S1 intentionally avoided the combination of other strategies because he felt there was an error in sketching for a  $5 \times 5$  square size. In fact, this error actually does not exist. This error is caused by sketches produced by S1 using a unit square not exactly the same size so as to produce a square with a side length that seems not to be the same length. This can be seen from the dialogue S1(18).

I(15): "Why didn't you continue sketching the  $5 \times 5$  square image?"

S1(16): "I'm still confused"

I (17): "What difficulties did you experience when sketching a  $5 \times 5$  square image?"

S1(18): "It should be the same length and width as the square, but it is not in my sketch. There must be something wrong."

In the final phase, verifying the solution that has been produced, S1 took evasive actions. S1 did not check his answers. This can be seen in the transcription of S1(34). In addition, S1 also experienced ED6 because he was not aware of errors existing in the solutions he produced.

I(19): "Have you reviewed the solution before collecting?"

S1(20): "No"

I (21): "Why didn't you do it?"

S1(22): "Yes, actually there was still time to check, but I want to finish quickly so that it can be collected soon."

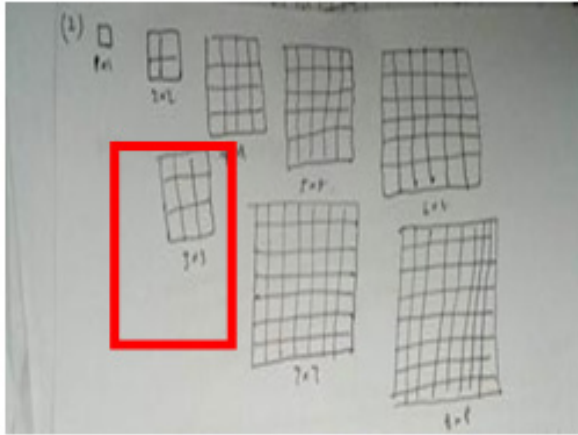
I (23): "Are you sure the solution you produced is correct?"

S1(24): "Yes"

Furthermore, the solution to the second problem is described in Figure 4. In this problem, the subject was asked to calculate the number of all squares on the chess board measuring  $8 \times 8$ . In Figure 4, it appears that S2 described a square of size  $1 \times 1$ ,  $2 \times 2$  and so on to  $8 \times 8$  regardless of color differences. Therefore, the final answer obtained by S1 is 8 square.

Figure 4 shows the process of resolving the second problem carried out by the S1 indicates mathematics anxiety. This can be seen from the results of the observation of S1 during mathematical problem-solving. S1 sketched a chess board of size  $1 \times 1$ ,  $2 \times 2$  then jumped directly to the chess board size  $4 \times 4$ ,  $5 \times 5$ , and  $6 \times 6$ . S1 paused for a while. Furthermore, S1 calculated the number of sketches

of the chess board that had been made—they were five, while he wrote the size of the last chess board made was  $6 \times 6$ . Then, S1 realized that the sketch for the  $3 \times 3$  chess board was skipped and immediately drew it, followed by sketches for chess board of  $7 \times 7$  and  $8 \times 8$ .



**Figure 4.** The Mathematics Anxiety Indicator Experienced by S1 in Resolving Problem 2

In the early phase, S1 experienced ED1. S1 made a mistake in determining what was asked, but he did not realize the mistake. This can be seen in the interview transcription of S1(38).

I(25): “Can you retell what is asked in problem number two?”

S1(26): “Determining how many squares on the  $8 \times 8$  chess board”

I(27): “How do you do that?”

S1(28): “As far as I know the number of squares on the chess board can be counted directly because there are 8 square rows as many as 8 columns, so there are 8 square”

I(29): “Are you sure that’s what is asked in the question?”

S1(30): “Yes, sure. This can also be done by observing the pattern, square size  $1 \times 1$ , square size  $2 \times 2$ , and so on. The maximum is only up to  $8 \times 8$  square, so there are 8 squares on the  $8 \times 8$  chess board”

In analyzing the problem, it can be seen that S1 experienced ED2. This is based on the interview transcription of S1(28). S1 was not aware of errors in determining the number of squares. S1 only showed that a chess board of size  $8 \times 8$  could be formed by a square size of  $1 \times 1$ ,  $2 \times 2$ ,  $3 \times 3$ ,  $4 \times 4$ ,  $5 \times 5$ ,  $6 \times 6$ ,  $7 \times 7$  and  $8 \times 8$  as many as one each square. S1 did not realize that there were 64 squares on an  $8 \times 8$  chess board.

In the phase of exploring problems, S1 experienced LP3. Not only being failed to realize the number of squares size of  $1 \times 1$  on the  $8 \times 8$  chess board in the previous troubleshooting phase, he also did not realize that a square size of  $2 \times 2$  on a chess board is more than 16. S1 forgot the fact that there is a unit square that intersect on a chess board. This is shown in the dialogue transcription of S1(44) as follows.

I(31): “How many squares with size of  $2 \times 2$  are on the chess board?”

S1(32): “If there are  $2 \times 2$ , there are 16 with 4 squares sideways, and 4 squares down because the size of the chess board is  $8 \times 8$  square unit.”

I(33): “Then why is the solution that you produced only written 1 for square size  $2 \times 2$ ?”

S1(34): “Based on my understanding it is enough to be represented by just one; it’s the same size of  $2 \times 2$ ”

In the phase of planning problem-solving, again the S1 experienced LP4. In this case, S1 only used one solution, sketching of an image, whereas in solving this problem, S1 is required to be able to combine sketches of images and patterns of numbers produced. This can be seen in the dialogues I(35) and S1(36) in the following.

I(35): “In addition to sketching square drawings like this, what other strategies do you think to solve this problem?”

S1(36): “I think this problem can only be solved with images like this because it makes it easier to imagine the actual chess board conditions”

In the phase of implementing the problem-solving plan, red flag experienced by S1 is ED5. S1 did not realize that there is no square of the chess board having the same color as the sketch of the image he made as in Figure 3.

The final phase in problem-solving is the verification. In this phase, S1 also experienced ED6. This *red flag* is a result of *red flag* in the previous phase. S1 verified that the answer was appropriate. According to S1, there are 8 squares produced, square size  $1 \times 1$  to  $8 \times 8$  each number 1.

### 3.2 Description of the Problem-Solving Process by Subject 2 (S2)

In the phase of understanding the prob-

lem, S2 failed to find what was asked in the problem. This can be seen in the interview transcription S2(44) that S2 experienced ED1.

I(37): "What is asked in the first problem?"

S2(38): "Finding the number of different squares on the chess board."

I(39): "What do you mean by different?"

S2(40): "Different means not the same."

I(41): "Well, if I have an  $8 \times 8$  chess board, how many different squares size of  $1 \times 1$  on the chess board?"

S2(42): "32 white and 32 black"

I(43): "32? Isn't this the same square, both white and equal size  $1 \times 1$ ?"

S2(44): "Different, even though the size and color are the same, this is a square located on the first row, while the other square is located on the second row."

Furthermore, in analyzing the problem, S2 experienced ED2. S2 described white squares of size  $1 \times 1$  on a chess board as many as 32. In addition, S2 described the number of black squares measuring  $1 \times 1$  on a chess board as many as 32. Errors made by S2 in this case are to assume that the 32 square units are different squares (location), but actually they are the same (in size and color). ED2 that occurred when S2 analyzed the problem was a result of ED1.

In the phase of exploring the problem, S2 experienced an AR3. S2 described a square size of  $2 \times 2$  as many as 16. This was in consideration that a square size of  $4 \times 4$  has 4 rows and 4 columns in a square size of  $8 \times 8$  (chess board). The process of sketching a square of size  $3 \times 3$  was not done because the square arrangement of size  $3 \times 3$  cannot form an  $8 \times 8$  square, whereas it actually can, because there are  $3 \times 3$  square sections that intersect each other. This is shown in dialogues S2(48) as follows.

I(45): "Why didn't you draw  $3 \times 3$  square?"

S2(46): "Because a square of size  $3 \times 3$  cannot close a square of size  $8 \times 8$  perfectly, remaining two columns and these two lines"

I(47): "What about the size of a  $4 \times 4$  square units?"

S2(48): "Because the chess board is  $8 \times 8$ , it's a  $4 \times 4$  square right to cover it, and it takes 4 square  $4 \times 4$  to cover the  $8 \times 8$  chess board. This is the largest square,  $5 \times 5$  and so

on, it can't be cover anymore."

The next step is to plan problem-solving. S2 experienced LP4 because the information collected in the previous phase was wrong; the error resulted in the same *red flag* in this phase. S2 was not able to use the pattern to find a solution to the problem number 1 because based on the information gathered in the previous phase, S2 did not apply the chosen strategy to all unit square sizes, only on square sizes  $1 \times 1$ ,  $2 \times 2$ ,  $4 \times 4$ . In this case, S2 did not realize that the difficulty he experienced in representing other sizes of squares actually did not exist because the unit square can intersect with each other. At this phase, S2 tried to understand the existing pattern but eventually failed and decided to work on the strategy only.

In the phase of implementing a problem-solving plan, S2 completed the problem for a  $4 \times 4$  square unit of 4 squares. This is obtained from a  $4 \times 4$  square arrangement in an  $8 \times 8$  square forming 2 rows and 2 columns. At this phase, S2 experienced LP5. Initially S2 doubted whether the  $3 \times 3$  square was included in the solution or not. This is indicated by the scribbling on the results of his work on a square image below a  $2 \times 2$  square. S2 had difficulty in representing a  $3 \times 3$  square unit size on the chess board. Also in this phase, the indication of mathematics anxiety can be found. After S2 sketched a  $2 \times 2$  chess board, S2 tried sketching another square size with a larger size. However, the sketch he made was a rectangular instead of a square. In addition, S2 shaded the adjacent square (top-bottom), whereas the square arrangement should be alternating (black followed by white and vice versa). This sketch can be seen in Figure 5.

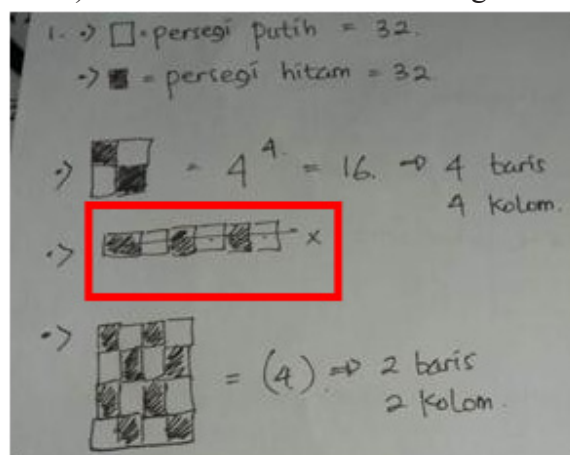
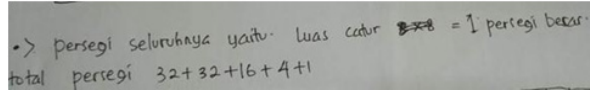


Figure 5. The Mathematics Anxiety Indicator Experienced by S2 in Resolving Problem 1

At the end, S2 re-checked the answers that had been generated to ensure there were no miscalculations. At this phase, S2 did not realize that he had not added the total square. In the previous phase, S2 wrote the solution as  $32 + 32 + 16 + 4 + 1$  as shown in Figure 6. So, it can be concluded that S2 experienced ED6.



**Figure 6.** The Final Solution to Problem Number 1 by S2

The same thing was done by S2 in question number 2. In the phase of understanding the problem, S2 did not realize that there were two possibilities for unit square colors. For example, in a unit square measuring  $1 \times 1$ , S1 only described it in black, not in white. Therefore, it can be concluded that in this phase S2 experienced ED1.

Furthermore, in analyzing the problem, S2 assumed that the square unit of size  $1 \times 1$  was in a  $2 \times 2$  square unit and so on. Therefore, S2 would use the strategy by reducing the number of squares on the pattern he made with the previous square. S2 was not aware of this mistake, so it can be concluded S2 experienced ED2.

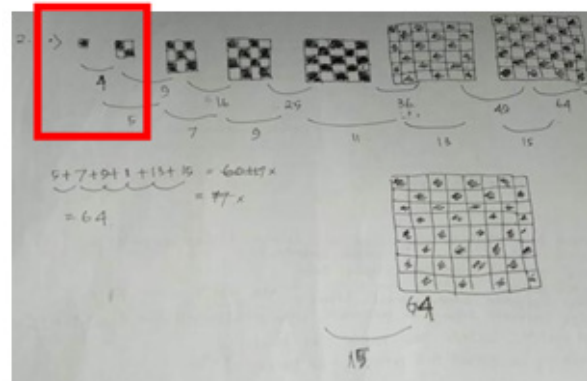
Next, in exploring the problem, S2 experienced an LP3. S2 calculated the number of squares in the sketch of the picture he made. In a square of size  $1 \times 1$  there is 1 square, on the size side of  $2 \times 2$  there are 4 squares so on until the square size  $8 \times 8$  is a chess board. S2 had an overlap; a square calculated on a square of a larger size has actually been calculated before working with a smaller square.

The next step is to plan problem-solving. In this case, S2 did not realize that the way he used to answer what is asked was not right. S2 experienced ED4; this is indicated by the attitude of the S2 who continued using the method he chose. S2 tried to find a number pattern but in an inappropriate way.

In the phase of implementing the problem-solving plan, S2 was asked to determine how many squares were in the chess board without regarding the color differences. To produce a solution to this problem, S2 made a  $1 \times 1$  square, followed by a  $2 \times 2$  square and so on to square size  $8 \times 8$ . Numbers below the square show the number of square units that are in each square. While the numbers in the second row show the difference from the number of units that are written in the first row as in Figure 7. The *red flag* that occurs in this

phase is ED5.

In the phase of implementing the problem, the indication of mathematics anxiety experienced by the S2 can be found when solving the second problem. In this case, S2 calculated the number of square units on a  $2 \times 2$  chess board 4, a chess board of size  $3 \times 3$  as many as 9, and so on until a  $8 \times 8$  chess board of 64. In this case, S1 skipped the chess board of size  $1 \times 1$  consisting of 1 square unit. As a result, in the next calculation process, S1 calculated the deviation in the number of square units of chess board size  $3 \times 3$  (as many as 9 square units) and  $2 \times 2$  (as many as 4 square units), namely  $9 - 4 = 5$ . But in fact, when it was following this pattern actually the first calculation is the deviation in unit square on a chess board of size  $2 \times 2$  (as many as 4 square units) with a chess board of size  $1 \times 1$  (as many as 1 square unit), namely  $4 - 1 = 3$ .



**Figure 7.** The Mathematics Anxiety Indicator Experienced by S2 in Resolving Problem 2

At the final phase, the verification phase, S2 also experienced ED6. This can be seen when S2 wrote the final result of the answer as  $5 + 7 + 9 + 11 + 13 + 15 = 60$ . However, S2 wrote it as 64. In general, the process of metacognitive blindness that occurs in subject 1 and subject 2 can be seen in the Table 7.

**Table 7.** Redflag of S1 and S2

Phase	S1		S2	
	Problem 1	Problem 2	Problem 1	Problem 2
1	ED1	ED1	ED1	ED1
2	LP2	ED2	ED2	ED2
3	LP3	LP3	AR3	LP3
4	LP4	LP4	LP4	ED4
5	AR5	ED5	LP5	ED5
6	ED6	ED6	ED6	ED6

## 4. DISCUSSIONS

Mathematics is built on several cognitive abilities (Geary, 2011), is implemented by neural networks in the brain (Goswami and Szűcs, 2011; Fias, Menon, and Szűcs, 2013), and is influenced by emotional aspects (such as feelings of fear, dislike, tension, worry, frustration, and fear) experienced when solving mathematical problems, known as mathematics anxiety. Regarding the relationship between mathematics anxiety and cognitive processes, previous studies have shown that individuals with limited working memory capacity have difficulty in regulating their anxiety levels (Hofmann, Smits, Asnaani, Gutner, and Otto, 2011). In addition, anxiety can reduce working memory resources (Mammarella, Hill, Devine, Caviola, and Szűcs, 2015). It is common knowledge that cognitive skills such as working memory, processing speed, attention and obstacles are important in regulating the difficulty of learning mathematics (Fletcher, J. M. et al, 2007). In line with these findings, mathematics anxiety causes disruption of the subject's ability to maintain his attention capacity (Ramirez, Gunderson, Levine, and Beilock, 2013). From the description above, it can be traced that metacognitive blindness is one type of metacognitive failure caused by the lack of attention of the subject in the problem-solving process, which is derived from the existence of mathematics anxiety. Meanwhile, metacognitive mirages are part of metacognitive failure originating from the subject's excess attention to a problem. The impact of excess attention is that the subject becomes aware of things that are not really necessary. This causes the subject to always feel there is something wrong/incongruity.

In the process of solving mathematical problems, there may be difficulties, process errors, or results. *Red flag* is a sign of difficulties, process errors, or errors in the results of problem-solving (Goos, 2002; Goos, Galbraith and Renshaw, 2000). *Red flag* is a trigger for metacognitive activity when a person is aware of certain difficulties (Stillman, 2004). *Red flag* occurs in problem-solving when someone experiences LP, ED, or AR.

LP is a condition when a person experiences obstacles or *deadlock* in the problem-solving process (Goos, 2002). In his research, Goos (2002) states that LP occurs in the exploration phase (the third phase) which demands to reanalyze the problem and reassess the chosen strategy, and then assess understanding and seek new information or strategies. How-

ever, in this study LP does not only occur in the third phase of problem-solving, but it also appears in the third phase. LP also exists in the second and fourth phases of the S1, and the fourth and fifth phases in S2.

Meanwhile, Goos, Galbraith, and Renshaw, 2000 state that *error detection* is a warning when someone experiences a process error at the implementation/ application phase requiring someone to check and correct errors. ED is a *red flag* that dominates the problem-solving process performed by both subjects. Furthermore, Abdullah, Abidin, and Ali (2015) explain that several errors can occur in the phases of the problem-solving process.

First is *reading error*, an error in reading problems. Reading is the initial phase of problem-solving and is included in the cognitive domain; therefore, it is not discussed further in this study. This is done by considering the condition of the subjects as pre-service teachers who certainly do not experience obstacles in reading the problem.

The second is *comprehension errors*, which occur in the phase of understanding the problem and when someone misunderstands what is needed/known and what is asked. Students who experience mathematics anxiety need to have metacognitive therapy in the form of giving four types of questions; one of them is comprehension questions (Faradiba, Sadijah, Parta, and Rahardjo, 2019). Comprehension question provides a new appearance for the treatment of psychological disorders by underlining the significance of how a person thinks, rather than simply focusing on the content of his cognition.

The third is *transformation error*, an error in interpreting and identifying the appropriate mathematical operations to solve the problem. Transformation error occurs in the second and third phases of problem-solving. An error in this phase will always be followed by LP in the next phase. This is not surprising because the subject experienced a lack of information to keep going to the next phase.

The next is process skill error, an error in applying the work procedure. Process skill error occurs in the fourth and fifth phase of problem-solving. The error that occurs in this phase is the result of the previous error.

The last is encoding error, an error in writing the final answer. Encoding error occurs at the end of the problem-solving phase. This error can be single (only appears at the end of the problem solving phase), or not (as an effect of the error in the previous phase).

Each phase of problem-solving is ex-

pected to produce appropriate results, but in reality, this may not be the case. AR is an odd/unusual result that can happen; a lot of the results obtained is strange (strange results) or odd (anomalous results) (Goos, Galbraith, and Renshaw, 2000; Goos, 2002; Stillman, 2004).

Mathematics anxiety causes worse mathematical performance. This happens because of the temporary reduction in cognitive resources needed in solving mathematical problems. The cognitive resources referred to here are working memory (WM). WM is a short-term memory system that controls, regulates, and actively maintains a number of information that is relevant to the problem at hand (Engle, Tuholski, Laughlin, and Conway, 1999). In line with this opinion, anxious subjects tend to be slow in processing information. This is due to the consideration to the reduced capacity of WM so that seeking information strategies tend to take place partially, not thoroughly (Leon, 1989). Therefore, the process of gaining information during the effort of problem-solving is incomplete. The incompleteness that occurs is not because the subject is incapable, but it is merely because the attention of the subject is limited due to the mathematics anxiety. In this study, it can be seen in Figures 3, 4, 5, and 7. In Figure 3, it appears that S1 skips sketching the chess board of size  $5 \times 5$ ,  $6 \times 6$ ,  $7 \times 7$ , and  $8 \times 8$  even though S1 has been sketched chess board measuring  $1 \times 1$ ,  $2 \times 2$ ,  $3 \times 3$ , and  $4 \times 4$ . In Figure 4, it appears that S1 skips drawing process of a  $3 \times 3$  chess board size, even though he has been sketched chess boards of size  $1 \times 1$ ,  $2 \times 2$ ,  $4 \times 4$ ,  $5 \times 5$ , and  $6 \times 6$ . In Figure 5, S2 sketches a chess board that is not square and with the same color arrangement adjacent to each other (instead of alternating colors; adjacent squares have different colors), surprisingly the previous sketch made earlier, which is a  $2 \times 2$  chess board, is square and has an alternating color arrangement. In Figure 7, S2 skips the unit square calculation on a chess board measuring  $1 \times 1$ , even though S1 calculates the number of unit squares for all other chess board sizes.

In this case, S1 and S2 experience total metacognitive blindness because they experience a red flag in each phase of problem-solving. Further research is needed to examine whether it is possible to solve the red flag that occurs on the pre-service teacher in several phases of problem-solving. Metacognitive blindness occurs when the subject is not aware of errors in the problem-solving process (Goos, 2002). This can be seen from the

attitude of the subject who survives with the wrong strategy or ignores calculation errors. Other metacognitive failures are metacognitive mirage and metacognitive vandalism (Goos, 2002). Metacognitive mirage occurs when the subject feels there is an error/incongruity during the problem solving process, but actually there is no error/incongruity. In this case, the subject mistakenly leaves a useful strategy, changes the calculation that is not wrong, or rejects the correct answer. Meanwhile, the subject is said to experience vandalism if he takes destructive action to overcome the impasse. It is when the subject can change the problem by imposing an inappropriate conceptual structure to enable them to apply the knowledge that is already available in their thinking scheme. In other words, there are two possibilities for the flow of metacognitive failure experienced by the subject that leads to metacognitive destruction. First, metacognitive blindness is followed by metacognitive destruction. Second, metacognitive mirages are followed by metacognitive destruction.

## 5. CONCLUSIONS

Mathematics anxiety causes metacognitive blindness experienced by the pre-service teacher. This metacognitive blindness is caused by the presence of a red flag in each phase of problem-solving. The dominant type of red flag is ED. This result is very surprising because the ED that occurs actually starts from the first phase of problem-solving. Considering that the subjects are the pre-service teachers, they should have no difficulty in understanding the problem. In other words, metacognitive blindness that occurs is caused by subjects who only read the problem at first glance at the beginning of the problem-solving process and less deeply explore the meaning. Mathematics anxiety limits the pre-service teachers' ability to struggle with mathematics. Therefore, it is necessary to further study the metacognitive process in the phase of understanding the problem.

This study also finds that S1 and S2 have different problem-solving processes. S1 experiences mathematics anxiety dominant in the first factor which is the incompleteness of processing information in the first stage of understanding the problem in learning mathematics. Meanwhile, S2 experiences mathematics anxiety dominant in the second factor, namely the anxiety in facing the mathematics exam. S2 has incomplete information processing at

the stage of implementing problem-solving plan. It means that the effect of mathematics anxiety on subject who has dominant anxiety in the first factor is higher than the subject who is dominant in the second factor. In other words, metacognitive blindness experienced by subject whose dominant source of anxiety originates from anxiety while learning mathematics occurs early and gradually settles down to the end of the problem-solving process. Meanwhile, metacognitive blindness that occurs in subject whose source of anxiety is dominant in anxiety during the mathematics exam only takes place in the middle of the problem-solving process.

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### Conflict of interests

The authors declare no conflict of interest.

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## FEATURES OF MENTAL ACTIVITY OF STUDENTS – ESPORT PLAYERS

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### ABSTRACT

The study of the peculiarities of thinking of young people professionally engaged in computer gaming activity is a new and little-studied topic in cognitive psychology. The article presents the results of empirical research of peculiarities of thinking of students-e-sport players and students engaged in computer gaming activities or amateur players. The sample consisted of students-eSports players and students who are not engaged in eSports aged 17 to 20 years. Such techniques were applied: «Intelligence structure test» by Amthauer, R. (IST), «Test of critical thinking» by Starkey, L., the technique «Thinking style» by Belousova, A. K., «Brief indicative test (BIT)» by Busin, V.N., Vanderlik, E.F. The article presents data proving the fact that students who spend more than four hours a day playing computer games have a relatively lower level of logical and critical thinking than students who do not play computer games. The results demonstrate statistical connections between the indicators of gaming activity and the peculiarities of thinking. The factors influencing the low level of formation of logical and critical thinking among students-eSports players are discussed.

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## 1. INTRODUCTION

The problem of studying the impact of the computer environment, in particular the game virtual reality on the socio-psychological characteristics of the person is increasingly of interest among psychologists. The relevance of psychological studies of the impact of gaming computer activities on the functioning of cognitive processes of a human, his thinking, is due to the need to develop educational programs that promote the development of mental

activity of boys and girls involved in eSports. Computer games are one of the main ways to spend leisure time among young people, and systematic gaming activities in the network has an ambiguous effect on the development of mental processes.

The Russian Federation included eSports in the official register of sports in 2016, this discipline is qualitatively new and has no analogues in the historically established list of sports, and therefore there is the relevance of its research. ESports is a game competition using computer technology, in this type of activity, the computer simulates a virtual space within which participants compete. An attractive feature of eSports is its democracy in relation to the physical capabilities of the competitors. The attractiveness of computer games is due to a number of factors: the plot, emotional atmosphere, graphic aesthetics, «swinging» or the ability to acquire new skills, the achievability of the goal, obtaining intellectual pleasure,

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etc. (Boyle, E., Connolly, T. M. and Hainey T., 2011; Makalatiya, A. G. and Matveeva, L. V., 2017). Today, the authors (Avetistova, A. A., 2005; Granic, I., Lobel, A. and Engels, R. C. M. E., 2014; Sherry, J. L., 2004) introduce one more factor that may well form the attractiveness of online gaming. It is experienced, implemented «flow experience». It is associated with the phenomenon of the experience of immersion in games (Jennett, C., et al., 2008). The immersion involves complete disconnection from reality, the loss of time frames. The immersion is greatly influenced by the game's graphic design elements (Roohi, S. and Forouzandeh, A., 2019).

Interactivity of a computer network game allows to involve real players in virtual joint activity, making them active subjects influencing events in the game and with absolute freedom of expression (Burlakov, I. V., 2000). The computer game is a formative activity in which «there is an embedding of the received virtual game experience in real structures of the personality, and the result of such embedding is difficult to predict» (Polutina, N. S., 2010, p. 94).

In accordance with the assertion, derived by Orekhov, S. I., the mechanism of formation of virtual reality is divided into two stages: position and representativeness (Orekhov, S. I., 2002). Position helps players navigate in virtual reality: the playing individual has an idea of how he can interact with the objects of the game. Representativeness is that a computer game reflects a certain pattern of actions. There is a large number of game genres: from the shooter to simulator of God. All of them is a representation of certain laws and ideas from the real world. Positional-representative mechanism in advance gives us an idea of what the characters look like, what the playing field looks like, what the rules are. However, in addition to the position and representativeness the game also includes the area of fantasy – not in the human head, but between a man and a computer. Therefore, it would be wrong to talk about the aircraft simulator or chess on the computer screen as a computer game in the true sense of the word (Vishnevskij, A. V., 2014). In the research of psychologists who study the impact of computer games on the development of the cognitive sphere in adolescence, both positive and negative results of such influence are presented. Some works indicate that the computer players characteristically developed logical thinking, emotional stability, rationality, foresight, ability to make difficult decisions and successfully collaborate

with others (Fomicheva, YU. V., SHmelev, A. G. and Burmistrov, I. V., 1991; Sylvén, L. R. and Sundqvist, P., 2012). In other works, on the contrary, the negative consequences of the transformation of the interests and motivational sphere of players, the ability to establish social contacts and cognitive abilities, the increase in aggressiveness and anxiety level, as well as the formation of gaming computer addiction are stated (Anderson, C. A., et al., 2010; Ivanov, M. S. 2004, Sobkin, V. S. and Evstigneeva, YU. M., 2001; Shapkin, A. S., 1999).

E-Sports players, of course, have certain psychological characteristics, which makes them a potential object of research within the framework of psychology. ESports is most popular among young people, so the authors consider that it is most appropriate to conduct research based on a sample of students. There are few works in the literature on cognitive styles specifics of the players (Bogacheva, N. V., 2014; Vojskunsij, A. E., 2010), especially professional eSports players. In this regard, it is of particular interest to study their logical, intuitive, style characteristics of mental processes. We assume that eSports players differ in their styles of thinking from the amateur players.

## 2. MATERIALS AND METHODS

The objects of the study were students aged between 17 and 20 years, engaged in eSports (hereinafter referred to as eSports players) and amateur players, not engaged in eSports. The total sample was 70 people of both sexes, girls make up 30% of the total sample. 30 students are engaged in eSports and 40 students are not engaged. ESports players have been members of computer multiplayer team game genre of multiplayer online battle arena developed by Valve Corporation for 3 years and more.

We were interested in the type of eSports and its specifics in our work with eSports players. The main game is a computer multiplayer team game Dota 2, which is a battle on the map of a special kind, which involves two teams, each team is a group of five players who control the virtual space heroes with certain sets of abilities, the purpose of the heroes is to destroy the enemy and save their own base. The success of the battle depends on the consistency of the participants on the battlefield in the virtual space. This game is an eSports discipline. Tournaments are held in

different countries of the world since 2015, the prize fund is estimated in millions of dollars.

The main research methods were: observation, interview, psychological diagnostics. The methodical tools were psychodiagnostic techniques: «Intelligence structure test» by Amthauer, R. (IST) (subtest 2 «Excluding the word», subtest 3 «Analogies», subtest 4 «Generalization», subtest 6 «Arithmetic tasks»); «Test of critical thinking» by Starkey, L. (2004), the technique «Thinking style» by Belousova, A. K. and Pishchik, V. I. (2015), «Brief indicative test (BIT)» by Bendyukov M. A. and Solomin I. L. (2006).

Such methods of mathematical and statistical analysis as descriptive statistics, Mann-Whitney U-criterion to identify the significance of differences, Spearman correlation analysis to define the closeness of the relationship features were used.

### 3. RESULTS

The results are presented in tables and figures. The results of the diagnostics of logical thinking of students by the method of Amthauer, R. IST are summarized in table 1 and are clearly shown in figure 1.

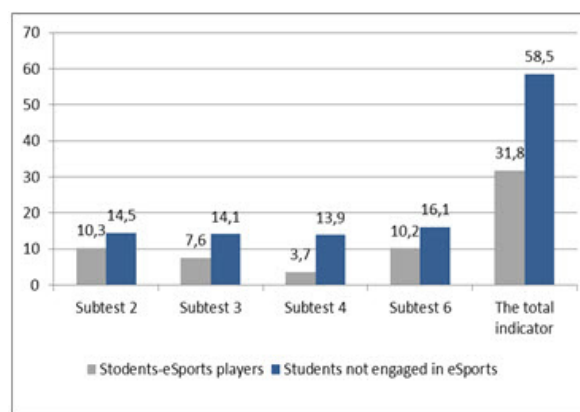
**Table 1.** Results of diagnostics of the level of development of logical thinking of eSports students and students who are not engaged in eSports

Indicator	Group of students-eSports players	Group of students not engaged in eSports	Mann-Whitney test
Subtest 2 «intuitive conceptual thinking»	10,3	14,5	57,000*
Subtest 3 «conceptual logical thinking»	7,6	14,1	51,500*
Subtest 4 «conceptual categorization»	3,7	13,9	17,500**
Subtest 6 «abstract thinking»	10,2	16,1	35,000**
The total indicator of logical thinking	31,8	58,5	26,500**

\* Differences are significant at the level of 0,05

\*\* Differences are significant at the level of 0,01

To assess the logical thinking of students such subtests were used: the second subtest – the development of intuitive conceptual thinking, the third subtest – conceptual logical thinking, the fourth subtest – conceptual categorization and the sixth subtest – abstract thinking. The diagnostic results showed that the level of development of logical thinking of students actively playing computer games is relatively lower than of the students who are not engaged in eSports, and the worst situation is with conceptual categorization. Then



**Figure 1.** Results of diagnostics of the level of development of logical thinking of eSports students and non-eSports students

The tasks of the second subtest are aimed at assessing the development of conceptual thinking operations based on intuitive analysis. These operations characterize the ability to see, highlight the main, significant thing in the descriptive, unstructured material, to understand the inner meaning of statements, messages, to separate the essential, constant properties, characteristics of objects and phenomena from the «external», secondary ones. The presence of conceptual intuitive thinking is necessary to use scientific, theoretical knowledge in real life. This intelligent operation is based on intuitive analysis. Mental activity is when a person gradually «cleans» information from all secondary, superficial, superfluous, cuts off, discards all unnecessary and leaves only its essence. Usually a person is not aware of the principle on the basis of which he acts when «cleans» information, makes a decision or makes a conclusion. He just feels, knows that it's important, that's right, and basically he does not make mistakes. The results of our study suggest that students-eSports players are characterized by a lower level of development of operations of intuitive conceptual thinking.

Tasks of the third subtest measure the development of operations of conceptual logical thinking. They characterize the ability to identify objective laws, the relationship between the phenomena of the world, allow to see the internal logic in the sequence of events, changes, isolate algorithms of activity. Through these operations the ability to understand the logic of evidence, the meaning of formulas, rules, their scope; generalize and partially transform their own knowledge and experience, transfer them, use in other, similar life or educational situations; «throw» logical bridges with a lack of information or knowledge gaps are formed, as a result the

possibility of understanding the general meaning of the message retain. Conceptual logical thinking characterizes the general ability to learn, can compensate for the shortcomings of any intellectual operations, provide an understanding of any tasks, problems and scientific constructions through reasoning. It is fully conscious, has an operational reversibility. It is used to search for cause-and-effect relationships, highlight the logical sequence in the presentation of information, evidence and justification of intuitive guesses, logical verification of conclusions, linking scientific constructions. Low rates of conceptual logical thinking of eSports players indicate that gaming activity forms a different direction of thinking of students.

The tasks of the fourth subtest reveal the development of the operation of conceptual categorization. These operations characterize the ability of forming concepts, define specific phenomena within more general categories, systematize knowledge, generalize, structure descriptive, empirical material through the creation of objective classifications. With their help, the characteristic of the phenomenon, the object is given by its generic affiliation, uniquely determined by its position (place) in the system of objective knowledge, it is possible to predict in advance the entire range of its essential characteristics. If the individual formed this operation, then object allocation and assignment to one category or another, determining its generic affiliation becomes a «simple» auto-execute action. The unit of thinking itself becomes larger, a person begins to operate with classes, not individual objects. Thinking becomes multidimensional, complex (linearity, unidirectionality disappear), the ability to theoretical modeling is formed. This ability allows to understand artificial systems (for example, programming languages), scientific constructions (for example, periodic table of elements, determinants used in botany or archeology, etc.). It allows you to easily see and learn the system of «artificial» rules that operate in a certain area, characterizes the sense of the structure of the language (or structural-linguistic abilities). On this subtest, the student players got the lowest value that shows the difficulties in the implementation of the categorization of concepts.

The tasks of the sixth subtest measure the development of formal logical thinking, the ability to operate with relationships, dependencies, regardless of the quality of the information content, to make various logical transformations of the operations themselves.

The subtest can characterize thinking of three types depending on what intellectual operations formal logical thinking (or symbolization of what is) is built on, what relations a person is trained to operate. On the basis of the developed conceptual thinking, a full-fledged abstract thinking can be formed, which raises the functioning of the intellect as a whole to a qualitatively higher level. A new, more perfect type of it arises. The owner of such intelligence receives significant advantages over other people. The speed and accuracy of information processing and penetration into its essence increase several times, because the very principle of its perception changes. In order to master any area of knowledge, a person with the intelligence of the «pre-abstract» type is forced to form a system of representations about this area, then analyze it, generalize and thus highlight the underlying patterns: it always takes a long period of knowledge accumulation, a lot of time is spent on its subsequent systematization. In the presence of abstract thinking the accumulation of knowledge is not required to understand the essence, the system of laws and relationships is captured as you become familiar with the new information. Emerging understanding is holistic and systematic, even if the information comes randomly. The process of familiarization with the material takes place through the imposition of available in the human head natural «abstract» grid that structures and systematizes any incoming information. Instead of a few years of training, a few months is enough for that. The quality of education is also significantly improved. Thanks to abstract thinking, a person sees the incorrectness of constructions, logical inaccuracies and errors in the process of mastering new areas of scientific or practical activity, which are not visible to specialists, if they do not have developed abstract thinking. Indicators of abstract thinking are also significantly lower in the group of students-eSports players.

The found correlations had the opposite character, which allows us to assert about the lower level of development of logical thinking among students-eSports players (table 2).

**Table 2.** Correlation analysis of eSports activities and indicators of logical thinking

Indicators	eSports activities
Subtest 2 «intuitive conceptual thinking»	- 0,370*
Subtest 3 «conceptual logical thinking»	- 0,470**
Subtest 4 «conceptual categorization»	- 0,670**
Subtest 6 «abstract thinking»	- 0,510**
The total indicator of logical thinking	- 0,570**

\* Correlation is significant at the level of 0,05

\*\* Correlation is significant at the level of 0,01

The least close correlation is observed in subtest 2, its tasks are aimed at assessing the development of conceptual thinking operations based on intuitive analysis. It can be assumed that the ability (or inability) of an individual to intuitively identify the main thing is least associated with active playing computer games. In turn, the closest relationship is obtained by subtest 4. Consequently, students-eSports players have less developed ability to identify and refer the object to a particular category, to determine its generic affiliation. Students playing computer games are more characterized by linearity, unidirectionality of thinking than the not playing students.

Table 3 presents the results of the diagnosis of the level of formation of general mental abilities, the level of critical thinking and thinking styles. The majority of the subjects experience obvious difficulty in the interpretation of the facts, statements, schedules, in determining the meaning of the values in the description of facts, events and their distribution by categories.

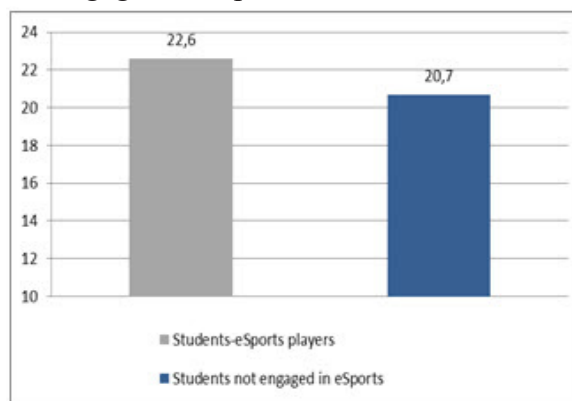
**Table 3.** Results of the diagnostic of the stylistic peculiarities of thinking of students-eSports players and students not involved in eSports

Indicator	Group of students-eSports players	Group of students not engaged in eSports	Mann-Whitney test
The level of general mental ability	22,60	20,70	174,000
The level of development of critical thinking	13,15	15,90	124,500*
Proactive thinking style	4,84	3,83	125,000*
Critical thinking style	3,96	4,54	182,500
Managerial thinking style	4,35	3,81	186,000
Practical thinking style	5,18	5,34	183,000

\* Differences are significant at the level of 0,05

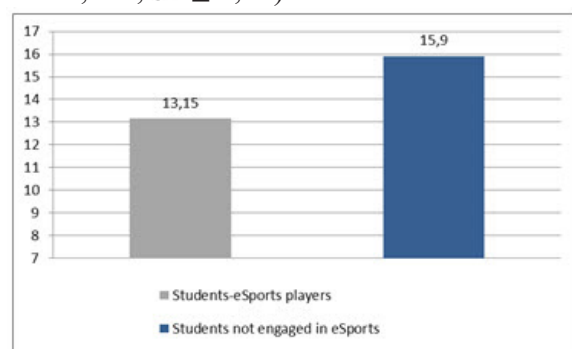
\*\* Differences are significant at the level of 0,01

We do not find significant differences in the level of general mental abilities among students-eSports players and students who are not engaged in eSports.



**Figure 2.** Results of diagnostics of the level of general mental abilities of eSports students and non-eSports students

ESports students have a lower level of critical thinking than non-eSports students ( $U = 124,500, p \geq 0,05$ ).



**Figure 3.** Results of diagnostics of the level of critical thinking of students-eSports players and students that are not involved in eSports

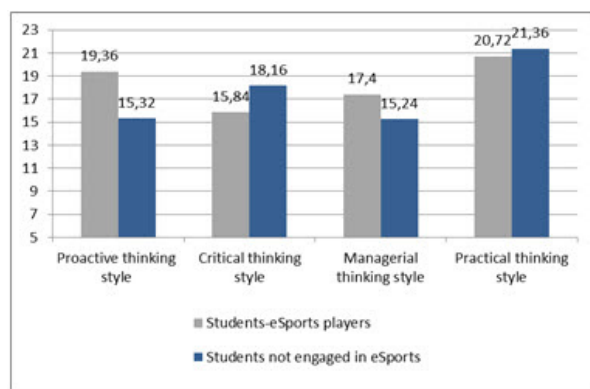
The ability to analyze, identify significant arguments, planned and existing logical connections among statements, questions, concepts at a high level is typical for students with a high level of critical thinking. Students with a low level of critical thinking find it difficult to assess information or judgments analytically, ignoring obvious alternative points of view; find it difficult to make reasonable, judicious, error-free conclusions, identify the consequences arising from the data, formulate a strategy for finding and collecting information in order to clarify the evidence, design alternative hypotheses; it is difficult to substantiate key results, to present reasoning using convincing arguments, to create a graphical presentation to explain and illustrate the actual material.

An acceptable level of development of

critical thinking skills is characterized by the ability to apply critical thinking skills in the analysis and evaluation of their own or others' logical judgments in order to confirm, approve, correct reasoning or results.

The results of the test indicate an insufficient level of development of critical thinking skills among students-esports players.

To study the thinking style, the method of «Thinking style» by A. K. Belousova was used (Belousova, A. K. and Pishchik, V. I., 2011). In the research process of style of thinking, we obtained results that allow us to build a profile of thinking style of young players (figure 4).



**Figure 4.** Results of the diagnostic of the stylistic peculiarities of thinking of students-competitive players and students that are not involved in eSports

There are differences in the profile of thinking styles:

- Students-esports players' profile of thinking style is represented by the following combination of styles: PraTS – ProTS – MTS – CTS.
- Students who are not engaged in eSports are characterized by such profile: PraTS – CTS – ProTS и MTS.

Significant differences between students-esports players and students who are not engaged in eSports, were found in the expression of an proactive thinking style ( $U = 125,000$ ,  $\rho \geq 0,05$ ). For the rest of the thinking styles significant differences were not identified, but we can speak about the stylistic peculiarities in the mental activities of these groups of students, as they can be traced not only by the values of differences in summary measures of severity of thinking styles in groups, but also on the specifics of the structure of the averaged profiles of thinking style. Profile of students-esports players is dominated by the practical thinking style, then proactive, managerial, critical thinking style completes the profile. In

the profile of students who do not engage in eSports, also dominates the practical thinking style, but the second position in the profile is a critical thinking style, then equally expressed proactive and managerial thinking styles. Whereas the profile of the thinking style is a certain combination of functions aimed at the production and development of tumors, manifested in the dynamics and direction of human mental activity (Belousova, A. K., 2002), we can imagine this combination as a construct that is formed under the influence of external conditions, including human-solved certain tasks. I.e., if it is a general practice oriented the direction of thinking of students-esports players and students-amateur players, there are clear differences in the stylistic characteristics of thinking of these groups of students. The dominant function of realization of ideas of students-esports players is associated primarily with the function of generating ideas, finding new solutions, initiation of mental activity, further significant is the meaning, and in the last place is the function of selection of information. Presumably, we can connect this with the tasks that eSports students solve on a daily basis, carrying out specific gaming activities within the framework of team functioning. While students-amateur players are characterized by the conjugation of the function of practical implementation of ideas in the first place with the function of selection of information, and the function of generating ideas and their meaning to other people to a lesser extent determine the mental activity of this group of students, but it is equally important for its implementation. In other words, the style specificity of mental activity is formed under the influence of actual activity and the specificity of the tasks.

Correlation analysis of the relationship between the indicators of style features of thinking showed differences in correlation between groups of students-esports players and students who are not involved in eSports.

The following correlations were found in the group of eSports-students.

**Table 4.** Correlation analysis of style characteristics of students-eSports players

	The level of general mental ability	Critical thinking
Proactive thinking style	0,474(*)	0,472(*)
Practical thinking style	-	-0,517(*)
The level of general mental ability	-	0,916(**)
Critical thinking	0,916(**)	-

\* Correlation is significant at the level of 0,05

\*\* Correlation is significant at the level of 0,01

Proactive thinking style is positively correlated with the level of intelligence ( $r = 0,474$ ,  $P \leq 0,05$ ) and critical thinking ( $r = 0,472$ ,  $P \leq 0,05$ ). Critical thinking is negatively correlated with practical thinking ( $r = -0,517$ ,  $P \leq 0,05$ ) and positively – with the level of general mental ability  $r = 0,916$ ,  $P \leq 0,01$ ).

**Table 5.** Correlation analysis of the style characteristics of students not involved in eSports

	The level of general mental ability	Practical style of thinking
The level of general mental ability	-	-0,482(*)
Critical thinking	0,658(**)	-

\* Correlation is significant at the level of 0.05 (2-way).

\*\* Correlation is significant at the level of 0.01 (2-way).

There are few connections in the group of students not involved in eSports. The level of general mental abilities of students is positively correlated with critical thinking ( $r = 0,658$ ,  $P \leq 0,01$ ) and negatively – with practical thinking style ( $r = -0,482$ ,  $P \leq 0,05$ ).

In general, it was found that the entire sample of students is characterized by a low level of critical thinking skills, problem points are indicators of interpretation, analysis and self-regulation. Most students are characterized by difficulties in interpreting facts, graphic data, unable to identify strong relevant arguments «for» and «against». Despite the fact that such indicators as «assessment», «formulation of conclusions», «explanation» are in the majority of students and e-athletes in the area of high and acceptable levels of development, the problem of formation of critical thinking skills remains open. Indicators of the

level of critical thinking significantly lower in the group of students-eSports players.

Thus, the obtained results actualize the problem of further in-depth study of the peculiarities of mental activity of young people engaged in eSports, the creation and implementation of a system of relevant activities and complex projects for the development of scientific, educational and creative environment in the structures involved in the training of eSports players.

## 4. DISCUSSION

Games are actively included in the life of the younger generation. Computer game becomes a professional activity. There is a controversial problem – games develop cognitive processes or block their development in gamers. Most authors (Clark, K., Fleck, M.S. and Mitroff, S. R., 2011) pay attention to the study of perception, attention, memory of gamers and a lesser extent to thinking. Today, the study of the thinking styles of gamers is an extremely important problem. Bogacheva, N. V. and Vojskunskij A. E. (2015) showed that active players have the following stylistic characteristics of thinking: reflexivity, field independence, flexible cognitive control. Our study contradicts this study, we found out that the development of logical thinking of gamers is low, especially it concerns of conceptual categorization. Maybe this is due to the fact that the conceptual categorization is based on the gamer's vocabulary, his verbal intelligence. However, our data combined with the results of the study of Savchenko, A. A. and Nikishina, N. A. (2011) which proves that the fascination with computer games slows down thought processes.

Studies of the impact of computer games on the cognitive, intellectual processes of players are quite controversial. However, the evidence of developing, training nature of their influence on various processes – from the reaction rate to analytical thinking and cognitive control prevail.

## 5. CONCLUSIONS

In the course of the study, it was found out that students-eSports players, daily spending more than four hours playing a computer game, have a relatively lower level of development of logical and critical thinking than students who does not play computer games professionally.

There are significant differences between groups of students-esports players and non-esports players in the level of development of intuitive conceptual thinking, conceptual logical thinking, in the ability to conceptual categorization, abstract thinking and selective information processing. Through the correlation analysis statistically significant inverse relationship between the practice of esports and the level of development of logical thinking was discovered.

The majority of students in both groups have an obvious difficulty in the interpretation of the facts, statements, charts; in determining the meaning of; to describe facts, events and their distribution by categories. It is established that the level of critical thinking of students-esports players is lower than that of students not engaged in esports.

The differences of the style characteristics of thinking of students-competitive players and students that are not involved in esports professionally, expressed in the differences of the average profile of thinking and the specifics of the co-ordination of cognitive functions: the initiation of mental activity, selective sampling of information, mislabeled, applied to implement the ideas, were discovered.

The study of style features of thinking showed that there are differences in the profile of students' thinking styles:

- Students-esports players' profile of thinking style is represented by the following combination of styles: PraTS – ProTS – MTS – CTS, in mental activity the focus on practical implementation and generation of ideas dominates.
- Students who are not engaged in esports professionally are characterized by such profile: PraTS – CTS – ProTS and MTS, in mental activity the focus on practical implementation of ideas as a selection of information dominates.

In the group of students-esports players a closer and more complete correlation between the indicators of the style characteristics of thinking and the level of general mental ability was discovered.

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## Abbreviations

PraTS – practical thinking style, CTS – critical thinking style, ProTS – proactive thinking style, MTS – managerial thinking style.

## Conflict of interests

The authors declare no conflict of interest.

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# EDUCATION, TECHNOLOGICAL CHANGES AND ECONOMIC DEVELOPMENT OF BOSNIA AND HERZEGOVINA

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## ABSTRACT

Accumulation of knowledge, the role of education and innovations in the stimulation of economic development are important for understanding the endogenous theory of growth. The aim of this paper is to determine the strength and direction of relations between independent variables of education, technological development, innovations, foreign investments and the economic growth of Bosnia and Herzegovina (B&H). The relations between variables are assessed by multiple regression analysis for the period 2005 - 2017. GDP per capita (pc), as a measure of general wellbeing and economic development is a dependent variable of the regression model. Education Years Average, Technological readiness and Innovations are explanatory variables, whereas Foreign investments and Macroeconomic environment are control variables. The results indicate statistical significance of variables Education Years Average, Technological readiness and Innovations. The first two variables indicate a positive effect on the economic development, whereas Innovations have a negative effect on the economic development. The control variables are statistically insignificant. Therefore, more investment is recommended in the field of education, science and research. Institutions should be more developed and scientific-research systems should be harmonized with the European Union. It is the only way for B&H to be able to respond to global challenges when it comes to competitiveness, export and the GDP growth. Examples and experiences of this country can be useful for research activities in similar post-transition countries.

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## 1. INTRODUCTION

### 1.1. General approach

Bosnia and Herzegovina (B&H) is a small developing country. According to [Kuznets \(1960\)](#), small countries are those with less than 10 million inhabitants, while the

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World Bank and IMF hold small countries to be those having less than 1.5 million inhabitants. In 2017, there were 144 small countries ([World Meters, 2017](#)). In addition to the fact that transition has not been completed yet, B&H has a complex constitutional-legal structure made up of two entities, the Federation of B&H and the Republic of Srpska.

The educational system in B&H has not been fully reformed nor has it been harmonized with the European Union (EU) system and policies. The EU, as a global actor, allocates significant funds to education, research and development ([Erić, O., 2017](#)). The EU is in the process of structural changes such as the implementation of EU 2020 -A Strategy

for Smart, Sustainable and Inclusive Growth (Popović, G., 2016). The term “smart” refers to acquisition of new knowledge, including studying, lifelong learning, etc. The focus is on new technologies, innovations, ICT development, robotics, biotechnology, space exploration, etc.

The main aim of this research is to assess the impact of education, technological changes and innovations on the economic development of B&H. This implies that the main research subject of this paper is to establish the relation between technical progress and GDP growth per capita (pc).

Bosnia and Herzegovina does not meet EU standards or goals of the Strategy 2020. However, strategies and planning in the field of education and research are based on the European standards. The goal is to bring educational, scientific and research structure of B&H closer to the European model.

The economic development affects the system of education, science and research, which are ever more considered to be the condition for competitive production of goods and services. Nowadays, modern production requires appropriate accumulation of knowledge. Therefore, the assessment of impact of education, science, technological readiness, innovations and other forms of knowledge on the economic growth contribute to better understanding and implementation of policies and measures in the above indicated sectors.

Nowadays, in the era of globalization, democratic, developed and stable societies have ensured good quality systems of education, science and R&D. In such societies, economic and overall development depends on the synergy of impacts of all the factors mentioned above.

## 1.2. Literacy Review

The economic development and well-being are primary goals in modern states, assuming continuous and high rates of economic development. A global indicator of economic growth expresses changes in gross domestic product (GDP, output) in aggregate or pc. Traditionally, capital and work-force are the factors that create GDP:

$$Y = f(K, L) \quad (1)$$

Traditional theory of economic growth has been contributed by the Nobel Prize winner Solow, R. (1956). He introduced technical progress (accumulation of knowledge,

technological progress), which is a constituent factor of long-term economic growth. However, technological progress is given as an exogenous model in Solow’s model; therefore, this key factor that determines the rate of economic growth is not explained in the model at all. The new or endogenous theory of growth offers somewhat different explanation of economic growth compared to neoclassical theory. This theory in the growth models makes the technical progress endogenous. Foundations of modern endogenous theory of economic growth are being investigated by many researchers. Paul Romer, one of the founders of endogenous theory, received the Nobel Prize in Economics (2018), which confirmed the importance of education, knowledge and technological progress in the economic growth. Besides Romer (1994), significant contribution to development of this theory was given by his mentor Lucas, R. Jr. (1988), as well as by Grossman and Helpman (1991), Aghion, Ph. and Howitt P. (1992), and many other researchers.

Lucas Jr, R. E. (2015) considers that human capital contribution to economic growth is reflected in the affirmation of production function (economy of supply). According to Lucas, the human capital affects the economic growth outside formal education. Moreover, the human capital is considered to be the nucleus of growth. He argues that more skills are acquired when interacting with people rather than in formal education (learning by doing process). Greif and Mokyr (2017) base their approach to economic development on the importance of cognitive rules in two directions. One is the rise of the modern state with its legitimacy based on consent, and the other one is the rise of modern science-based technology. The second one is the product of the scientific revolution and the Enlightenment.

In addition to theoretical approaches, there are numerous empirical studies on the connection between education, technological progress and economic development.

Saviotti, Pyka and Jun (2016) identify that education brings positive impact on social mobility and increases the population share in the upper social class. These results are based only on education without taking into account any wealth effects. Hanushek (2016) states that differences in cognitive skills - the knowledge capital of countries - can explain most of the differences in growth rates across countries, but adding more years of schooling without increasing cognitive skills has historically brought small systematic influence on

growth. Wang and Liu (2016) stipulate that educated human capital has a positive impact on the economic growth. Higher education notably affects the economic growth, while primary and secondary education does not have a significant impact on the economic growth. Lauder (2015) argues that at least two fundamental gaps exist in education and economic development. The first one refers to the failure to identify the effects of the global economy on states and, in particular, the demand for educated labor. Grant (2017) argues that ignoring the economic dimension of education would endanger the prosperity of future generations, with wide-spread repercussions on poverty, social exclusion, and sustainability of social security systems. Surveying the most recent empirical evidence, Woessmann (2016) shows the crucial role of education for individual and societal prosperity. He believes that education is the leading determinant of economic growth, employment, and earnings in modern knowledge-based economies.

Innovations are considered to be the basis of economic growth and wellbeing. This hypothesis was investigated by Škare and Tomić (2014) in the analysis of effects of the so-called third industrial revolution for OECD countries for the period 1950-2013. They relate innovations and the growth of productivity. Given that GDP depends on technological changes, they assessed effects of technological shocks on GDP (in aggregate and pc) and labor productivity growth. It was proved that technological innovations significantly affect the growth, invoking higher future expectations.

Fu et al. (2011) studied economic development by assessing autochthonous and foreign efforts made in innovations and technological changes. This study has shown that benefits of liberalization and effects of technological developments, as global positive externalities, may be achieved only in modern, national innovation systems and with incentives. This clearly points out the need for complementarity of domestic and foreign innovation systems.

The relation between the economic growth and technological progress was investigated by Tomić (2012). He considers that innovations in developed countries are the result of technological progress and an unavoidable factor of economic development.

Pecea, Ecaterina, Oros and Salisteanu, (2015) identify a positive relationship between economic growth and innovations by using multiple regression models and the sample

of CEE countries where long term economic growth is affected by the innovation potential of an economy. Aghion, Akcigit and Howitt (2015) state that the Schumpeterian paradigm of more creative destruction implies stronger destruction of jobs, which reduces the wellbeing of currently employed workers. On the other hand, more creative destruction implies new job creation and higher growth rate, both of which should enhance wellbeing.

Toivanen and Vaananen (2016) studied the causal effect of MSc engineering education on invention, using data on the U.S. patents, the Finnish inventors and the distance from the nearest technical university as an instrument. They have identified favorable effect of engineering education on the tendency of the patent and negative OLS bias.

Freeman and Soete (2009) observe positive effects of technological changes in the context of positive externalities arising from the use of computer technologies and growing interests of the public and private sectors for investments in science and technology. Investigations of Kesici Çalışkan (2015) also indicate dependence of economic growth on scientific and research institutions, but also on the wellbeing of the society. Similar results got Kochetkov, Larionova and Vukovic D. B. (2017) when they tested impact of the universities on economic growth.

In his research, Freeman (2013) analyzed dynamics and features of global technological changes and their effect on the GDP growth. He selected the growing interest in the economy of innovations due to economic reasons and general goals. Malerba and Cantner (2006) provide an overview of development and evolution of industrial structure in the context of the evolution of Schumpeterian tradition. These processes are followed by changes in knowledge, technologies, innovations and institutions.

Aghion and Antonin (2018) have shown positive impact of innovation and creative destruction on social mobility. Acemoglu and Cao (2015) extended the basic Schumpeterian endogenous growth model by allowing incumbents to undertake innovations to improve their products, while entrants engage in more "radical" innovations to replace incumbents.

Finally, both the growth and liberalization of the world trade are processes that develop in parallel with global externalities growth. They are generated by continuous technical and technological changes.

## 2. MATERIALS AND METHODS

Several data sources were used to assess relations between the variables. Global Competitiveness Reports from World Economic Forum (WEF) was used as the main source, wherefrom we retrieved: Innovations as the score value, Technological readiness and Macroeconomic environment. Data on dependent variable GDP pc and control variable Foreign Direct Investments (FDI) were retrieved from the World Development Indicators, World Bank official (WB) data-base.

A dependent variable GDP pc is a general measure of wellbeing, of living standard and the level of development. The above indicated source was used to analyze this indicator, according to the purchasing power parity for the base year of 2011.

Education Years Average, as an explanatory variable in the model, presents an average number of years of education referring to the entire population (data retrieved from the official Internet site, the United Nations Development Program, Human Development Report).

Innovations as an explanatory variable in the model express the value of the score stated in the Global Competitiveness Report.

The explanatory variable Technological readiness in the model presents the ability to adopt technological changes. It is expressed in the value of the score, where higher value presents a higher rank in the global innovation index.

The FDI inflow is a control variable. It is used in the model as a relative indicator, compared to GDP. Otherwise, FDI is considered to be a significant driver of economic development. This particularly refers to developing countries such as B&H, which records chronic deficit in investments. Therefore, attracting FDI is one of the ways to accelerate the GDP growth, in aggregate and pc.

Macroeconomic environment is a standard factor to assess quality of an activity that the World Economic Forum has been analyzing and publishing for many years in the Global Competitiveness Report. In this paper, the rank of a country is used for the analyses whereby a higher rank indicates a lower position of the country.

Data on all the variables for B&H were collected within the period 2005-2017.

Following the investigations conducted by Pecea et al., 2015, and then Wang and Liu (2016), we used multiple regression analysis in this paper. The multiple linear regression model was used to assess the relationship

between dependent, explanatory and control variables. The aim of this method is to explore the connection between variables and to quantify the statistical significance of certain variables. The regression model shows an average composition of variation of the investigated incidence. The multiple regression model has the following equation (Koop, G., 2003):

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \dots + \beta_k x_k + \varepsilon \quad (2)$$

where  $x$  - means independent variable,  $y$  - dependent variable,  $\beta$  - regression parameter and  $\varepsilon$  is residual. The aim of regression analysis is to predict some values of  $y$  (dependent variable, GDP per capita in this paper), for a certain value of  $x$  (explanatory variables: The Education Years Average, Technological readiness and Innovations. The control variables are Foreign investments and Macroeconomic environment in this paper. The ordinary least square (OLS) method minimizes squares sum residual in order to estimate the unrecognized parameters in the sample. Furthermore, the OLS method estimates and minimizes the sum of squared residuals. The estimation of  $\beta_1$  and  $\beta_2$  is interpreted so that  $y$  (dependent variable) could be predicted with the change of  $x_1$  and  $x_2$ . The reliability of the model was accepted on the  $p$ -value and  $R$  square (adjusted  $R$  square). The  $p$ -value should be less than 0.05 (in some estimation the level could be higher - 0.10 or 0.15). The higher value of adjusted  $R$  square means that the model is more reliable.

## 3. RESULTS

The regression analysis was conducted in the program package XLStat. Table 1 presents the obtained results in three sections. The first section provides the results of sum statistics i.e. the quality of the entire model.

Determination coefficient  $R$  Square ( $R^2$ ) amounts to 0.92 and indicates that 92% of changes in the dependent variable (GDP pc) are explained by the common effect of explanatory variables in the model. Therefore, the summary results of the regression analysis show that statistical model is an appropriate model for the explanation of dependent variable changes compared to the overall effect of independent variables.

The results in the second section are in direct correlation with the first section and present the analysis of the variance through the relationships between the sum of least square regression and residual regression with

the number of degrees of freedom (values in which parameters can freely vary). The results of F test in the analysis of variance (ANOVA) show the test value of 16.74 with probability below 5%, meaning that statistical conclusions of the model are significant.

The third section presents values of explanatory and control variables coefficients in the model, the value of t test and probability i.e. individual statistical significance in explaining a dependent variable. The results indicate statistically significant variables in explaining dependent variables at the level of 5%: The Education Years Average, Innovations and Technological readiness. The Education Years Average and Technological readiness show positive direction, while Innovations are inversely proportional compared to GDP pc change. In addition, the third section shows that the observed coefficients of explanatory variables are small.

The control variables Macroeconomic environment and FDI net inflow are not statistically significant in individual explanation of changes in GDP pc in Bosnia and Herzegovina.

**Table 1.** Regression analysis results

<i>Regression Statistics</i>					
Multiple R	0,96				
R Square	0,92				
Adj. R Square	0,87				
St. Error	0,02				
<i>Anova</i>					
	<i>Df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Sign. F</i>
Regression	5	0,0387	0,008	16,8	0,001
Residual	7	0,0032	0,000		
Total	12	0,0420			

	<i>Coeff.</i>	<i>St. Error</i>	<i>t Stat</i>	<i>P value</i>
Intercept	3,9	0,10	37,3	0,00
<i>Education Years Average</i>	0,029	0,01	2,36	0,05
<i>Innovation</i>	-0,158	0,05	-3,22	0,01
<i>Technological readiness</i>	0,064	0,02	3,01	0,01
<i>Macroeconomic Enviroment</i>	0,001	0,00	1,55	0,16
<i>FDI</i>	0,01	0,00	1,55	0,16

The regression analysis results show interdependence between the constituents of accumulated knowledge and economic growth. The statistical analysis confirms the conclusion that the situation in the fields of education, science, research and innovations in B&H is not favorable. This was confirmed by the comparative WEF analysis, where global competitiveness indices have been published for most countries (GCI). In 2016, out of 137 countries, B&H is on the 103<sup>rd</sup> position (The Global Competitiveness Reports, 2017-2018). The global index is the sublimite pillar for various social fields. Pillars referring to education, science and research significantly deviate from an average rank. The pillar Primary education is in 56<sup>th</sup> position and is ranked higher than the overall index for B&H. The Quality of primary education is in 84<sup>th</sup> position, and the Primary education enrolment rate is in 43<sup>rd</sup> position. The pillar Higher education and training has been ranked slightly above the average, in 91<sup>st</sup> position. It includes: Secondary education enrolment rate in the 78<sup>th</sup> position and Quality of the education system in 131<sup>st</sup>, Quality of math and science education in 97<sup>th</sup> and Quality of school management in 122<sup>nd</sup> position. The regression analysis shows that GDP change is positively affected by technological readiness, given that the pillar Technological readiness takes the 69<sup>th</sup> position. This pillar includes Availability of the latest technologies - 82<sup>nd</sup> position, Firm-level technology absorption - 92<sup>nd</sup> position while FDI and technology transfer takes 107<sup>th</sup> position. Therefore, WEF considers FDI to be technical-technological dimension and the growth driver. Innovations take the worst position - 123<sup>rd</sup> with Quality of scientific research institutions in 106<sup>th</sup> position and Company spending on R&D in 126<sup>th</sup> position. WEF introduced a new GCI 4.0 concep-

tualized at the Fourth Industrial Revolution (4IR). It includes new moments/indicators: human capital, innovativeness and better use of technologies. It promotes education, science & technology, innovativeness & research as economic growth factors. According to GCI 4.0 in 2018, B&H was ranked in 91<sup>st</sup> position out of 140 countries (The Global Competitiveness Reports, 2018). The pillar ICT adoption is in 86<sup>th</sup> position, Skills in 87<sup>th</sup>, and Innovations capability in 114<sup>th</sup> position. Indicators within the pillar Skills are not homogeneous (Mean years of schooling takes 74<sup>th</sup> position, Skillset of graduates 133<sup>rd</sup>, Digital skills among population 88<sup>th</sup>, R&D expenditures 91<sup>st</sup>, Quality of research institutions 85<sup>th</sup> etc.). Obviously, indicators referring to Skills and/or Higher education and training correlate with the average rank for B&H.

Differences in contribution of certain fields, institutions and policies have an impact on the situation, development and planning in education, science and research. The future objectives should be innovativeness, transfer of technologies, technological readiness and adoption of the leading technologies, particularly in application of computer techniques, robotics, biotechnology, etc.

#### 4. DISCUSSION

The global world is undergoing fast changing processes. The changes are so dynamic that social sciences in certain fields are lagging behind in terms of technical, biotechnological and other researches. For example, although artificial intelligence technologies are greatly developing, research works on their implications in wider social context are delayed. The situation is similar in other advanced technologies: IT, bio-technologies, exploration of the space, etc. Although global changes may be adverse in social or other spheres, they are still part of general prosperity. Nowadays, the need for scientific considerations of global and national framework is required to determine the relation between relevant social factors. Priorities have also changed. Ideological, geo-political and geo-strategic issues used to be the priority, but these days the priorities are current changes in education, science, research, development, technology and innovations. These issues create the picture of the world in the XXI century.

Knowledge has become a modern paradigm that dominates, connects the modern world and breaks the established ideological-

political borders. Accumulated knowledge is the human capital in fact, which is the growth factor in the core of developmental economic theory. Many relevant authors consider the accumulated knowledge as the sublimite of education, science, research and innovations. Thanks to global networks, the scientific research works have become available to researchers and citizens. Practical application of research and innovations is higher and more time is needed to develop a new product or service. Hekkert, Suurs, Negro, Kuhlmann and Smits (2006) have proved that the innovation system is an important factor of technological changes. The evolution of innovation system is in parallel with technological changes. Hence, they have proposed monitoring of the process of functioning and development of the system of innovations. This group of authors suggests the scientific method of systemic mapping of innovation processes that affect technological changes. Sometime before, Dosi, Pavitt and Soete (1990) analyzed innovation theories, practices and politics. They chose five functions of new innovation processes. They emphasized implementation of strong innovation systems, research platforms and strengthening of infrastructure for development of strategic intelligences. Their attitudes are still present in the era of artificial intelligence, fifteen years later.

The economic interest is at the core of every human activity. Investigations and relevant theories indicate that almost all activities in fields of education, science and technological development, innovations and technology are economically motivated. Firms, institutions and individuals endeavor to accumulate knowledge with the ultimate goal of increasing profit, to ensure GDP growth, and to increase the volume of trade.

Technical and technological development goes hand in hand with domestic and international trade development. Cooperation and joint investments lead to consolidation of capital for the needs of research and development. Trade liberalization accelerates the process of technological changes. Dosi, Pavitt and Soete (1990) analyzed economic and technical changes in the context of trade development. They investigated technology gaps in the context of international trade. They have provided an overview of technological progress and economic dynamics. Several economists, a few of them who are the Nobel Prize winners, have investigated fundamental aspects of economic development related to education, science and technology, state of innovativeness,

and more. Some scientifically and empirically confirmed mathematical models of growth show that technical progress could be one of the crucial economic development drivers.

In their middle and long term plans, some developed countries plan to invest more money into new technologies that would eventually later lead to higher GDP growth. Because of that, the developed and developing countries invest resources in human capital. In relative terms, the invested resources vary by country. Regarding Europe, Scandinavian countries and Germany invest most. Strategy 2020 foresees that public and private investments into science and research will grow from about 2% to at least 3% of GDP until 2020. This was first achieved by Sweden and Austria. Slovenia allocates 2% of GDP into research and development (2016), whereas Croatia, Serbia and Bulgaria allocate 0.75-1%. Bosnia and Herzegovina invests below 0.2%. In relative values, Israel with the investment of above 4% GDP and South Korea are the world leaders. In absolute, along with the USA, investments grow in China, which has become the global technological leader in many fields of science and technology, with investment of 300 billion dollars per annum.

The B&H investments into scientific research are minor. The investment determines the quality of scientific and research institutions. The education system is facing problems, although the situation is a bit better than before. The system has been created in a complex constitutional legal organization, a unique one in the world (the state consists of two entities and three nations). Education is under the competence of entities, but certain functions have been transferred onto the B&H level. Some reforms have been implemented in primary, secondary and higher education, but the system has not yet been harmonized with the EU standards and practice. Private investors invest into education, particularly in higher education. Due to institutional weaknesses, good intentions have turned into contradiction. Corruption, political instability, migrations of young and educated experts, unemployment and labor market structural problems resulted in decline of education quality at all levels. The structure of those seeking jobs on the labor market is unfavorable. Institutions fail to plan output staff profiles and do not invest in retraining thus distorting the economic and political stability. Reforms in this sector are necessary for faster economic growth.

However, systems of education, science and technological development, innovations

and technology are based on experiences of the former SFRY. In the former joint state, B&H used to develop “heavy” and defense industry, wood industry and energetics. Huge business systems such as UNIS, Energoinvest, Šipad, Soko, RMK and others were developed. These business systems invested a lot into scientific research. Parts of that research culture and infrastructure are still functioning.

Foreign investments are the source of investments in a national economy and they present an indicator of readiness of domestic firms to adopt foreign technologies (Spitsin, Mikhailchuk, Spitsina and Vukovic, 2018). In the examples of transition countries like Croatia in the period 2001-2010, Bezić and Karanikić (2014) investigated the impact of technologies on the economic growth. FDI is seen as an efficient way of import and transfer of new technical-technological solutions. By analyzing the effects of foreign investments and transfer of technologies on GDP, they confirmed a positive relation between FDI and variables: transfer of technologies and GDP growth.

FDI in B&H is influenced by domestic resources offered, particularly qualified and highly educated work force. Some researchers emphasize the significance of the labor force price, but some of them prefer countries with higher qualified work force rather than those with cheap workforce. This implies the connection between the system of education, scientific research, innovativeness and the FDI inflow (Popović G. and Erić, O., 2018).

Further on, stable macroeconomic environment is important for the affirmation of knowledge. Otherwise, costs of education, science and research are reduced.

Therefore, along with key variables that determine the system of education, science & technological development, innovations & technological readiness, multidisciplinary control indicators are also significant. These indicators are FDI inflow and the situation in the macro-economic environment. By responding to the hypothesis on the impact of these variables on GDP growth, we will, de facto, provide answer to the question: Does B&H need reforms where knowledge and human capital are treated as strategic factors of development?

## 5. CONCLUSION

Education, science and research affect technological changes and economic devel-

opment. This has been proved by respectable scientific fundus, partially presented in the previous studies. This study is based on the hypothesis that the independent variables: Innovation, Education Years Average and Technological readiness affect the economic development of Bosnia and Herzegovina. Logarithmic value of GDP pc, which is an indicator of the economic growth and well-being, is the dependent variable in the regression model. To “foster” the model and to achieve higher overall significance, we included the control variables: Foreign direct investment net inflows (as % of GDP) and Macroeconomic environment. We applied the multiple regression method. Available and scientifically relevant time series for Bosnia and Herzegovina in the period 2005-2017 were used as input data.

The regression analysis results indicate the statistical significance of the following variables: Education Years Average, Technological readiness and Innovation. However, the intensity and directions of the variable changes differ. The impact coefficients of Education and Technological readiness show weak but positive impact on GDP pc growth. Both variables show the situation in education and scientific structures, whereby Technological readiness is connected to technological changes and the situation in industry. The obtained results correlate with the results obtained in previous studies (Grant 2017; Woessmann, 2016; Freeman and Soete, 2009). The third and the most important variable - Innovation, also shows significance, but its relation to GDP pc is negative. Namely, Innovation negatively affects changes in GDP pc. Previous studies mainly confirm positive impact of innovation on productivity and growth (Pecea et al., 2015, Wang and Liu, 2016). We have expected this result, given that Bosnia and Herzegovina invests minor funds into science, research and innovation. In addition, this country lacks the necessary institutional structure and legislation when it comes to innovation, protection of patents, copy rights, etc. Therefore, multiple regression analysis has proved that Education Years Average and Technological readiness contribute to higher rate of the economic growth in Bosnia and Herzegovina, while Innovations slow down the GDP pc growth trend.

The analysis show that the impact of the following control variables FDI and Macroeconomic environment is not statistically significant, although the variables increase, to a certain extent, the overall significance of the model. Finally, the high determination coef-

ficient proves that the intensity of dependent variable changes is highly determined by the action of explanatory and control variables.

Results confirm that Bosnia and Herzegovina has problems in the system of education, in scientific research and innovations. Nevertheless, small positive contributions of education and technological readiness indicate the potential and reserves of this country when it comes to human capital and accumulation of knowledge. These resources could be put into the function of economic development through the process of reforms and higher investments into education, science and research. The results lead to the conclusion that Bosnia and Herzegovina should resolve the deadlocks related to innovations and put them into the function of development.

Comparative analysis results are in correlation with the regression analysis results. Data on education, science and research in Bosnia and Herzegovina are presented in annual WEF Competitiveness reports. According to the reports, B&H is lagging behind the world when measured by the Global Competitiveness Index - GCI. GCI constituent parts are the pillars - education, science and research, which differ in relation to the average rank. The pillar Primary education is better ranked than GCI. Also, pillars Higher education and training, and Technological readiness are better ranked than GCI. On the contrary, FDI & Technology transfer, and the pillar Innovation are ranked lower, which was confirmed by the regression analysis results. The situation is similar when we apply GCI 4.0 standards, which favor accumulation of knowledge and affirmation of human capital, innovation and use of technologies. Education, science, research and innovation dominate in GCI 4.0 standards, as they are the factors of competitiveness and growth. The pillar ICT adoption is better than the average GCI 4.0, and the same stands for Skills. Innovation capability is below the average, which corresponds to the regression analysis results. The analysis proved that Innovation has a negative impact on GDP pc. In general, the indicators of the pillar Skills are not homogeneous given that educational and scientific-research system in Bosnia and Herzegovina is undeveloped and inconsistent.

The situation in Bosnia and Herzegovina requires a more realistic planning, greater investments and harmonization of the economic system with the system of education, science, research and innovations. There is no competitive production of goods and services

without accumulation of knowledge. Institutions and politics should play a stronger role, in particular in planning and encouraging development of education, science and research. Along with education, more investments must be allocated to all sectors that generate new knowledge.

Bosnia and Herzegovina should target the growth of innovations, faster transfers of technologies and further fostering of technological readiness. The country must achieve higher level of cooperation with the former SFRY republics, given that the production, educational, scientific and research systems of newly created countries comply with each other. However, reforms of the system of education, science and research should be implemented first and then the legislation should be harmonized with the EU. Common principles of the Strategy 2020 should be followed, regardless of the fact that nominal values of most target indicators for B&H are still elusive.

In the era of globalization, the general aim is to increase investment in education, science, research and innovation growth, better technological readiness and FDI. These are the factors that the social wellbeing depends on in developed countries. Hence, this is the only possible response to global challenges and the method to increase competitiveness, export and GDP. Educational and scientific system in Bosnia and Herzegovina is searching for new politics and reforms. The legislation framework and strategies for education, science and technological development are priorities, but radical increase of financial resources is also very important. Thereby, higher accumulation of knowledge requires an interaction with other sectors: rule of law, protection of intellectual property rights, encouraging companies to undertake research activities and innovations, liberalization, market economy development and democratization of the society.

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### Conflict of interests

The authors declare no conflict of interest.

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# TRANSFER OF MUSICAL ABILITIES AND POSSIBLE REFLECTIONS OF TEACHING CONTENT

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## ABSTRACT

The paper aims to indicate the direct link between the development of knowledge, skills and music abilities in the pedagogical practice which encourages concrete cognitive, psychomotor and affective processes that lie in basis of the transfer of learning. We analyzed the attitudes of the students of the Department of Music Art from the Faculty of Arts in Niš according to musical skills acquired in solfeggio teaching, in the context of their impact on the instrumental performance. Assuming that advancement of musical skills acquired in solfeggio teaching directly affects the field of instrumental performance and leads to the development of music potential, or development of musical abilities, at the level of sensory abilities, as well as at the level of understanding musical structures, the research, which established the student attitudes to evaluating different components of instrumental performance; correlation of solfeggio and instrumental teaching; importance of work on some elements in the solfeggio teaching and evaluating expressive elements in relation to the technical skills in the solfeggio teaching, was conducted. The results of conducted research confirmed basic hypothesis that students express high awareness of the narrow connectivity of solfeggio and instrumental teaching, equally evaluating work in all areas of solfeggio teaching. Simultaneously, they indicate the importance of educational experience in shaping the standpoints of students who showed positive attitudes about a possible reflection of the solfeggio teaching content and skills that are acquired in it, as well as there's a high degree of the use of skill acquired in solfeggio teaching in instrumental performance.

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## 1. INTRODUCTION

Education of musicians, with respect for all the specificity that affect the outcome of learning in many different areas, includes two basic aspects: Acquiring and storing music information and experiences on one hand and develop of musical skills on the other. The adoption of music knowledge offers an individual opportunity for musical development, while development of musical skills involves

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the integration of the cognitive and psychomotor area (Klemp, 2010). Understanding of music and musical language is mostly associated with theoretical music disciplines and it comes to the *cognitive area*. Everything that we usually call playing or singing techniques can be classified into the *psychomotor area*. In music education the role of affective, where it comes to the aesthetic education, the development of the ability of critical evaluation of musical content and differentiation artistic of non-artistic, with individual development of artistic personality, is highlighted. According to Blum's taxonomy of educational aims, adopted by the American Psychological Society at the 1956 convention, and in the 1990s, in accordance with the new educational requirements, the results of general education were categorized into three related areas: *cognitive area* – related to knowledge acquisition; *affec-*

*tive area* – which refers to the attainment of attitudes; *psychomotor area* – which refers to the acquisition of skills (Cvetković Crvenica and Miletić, 2019).

In a group of cognitive musical subjects that to a lesser extent include psychomotor area, we can classify: Solfeggio, Harmony, Polyphony, Musical forms, History of music, Composition, Music pedagogy, Musical instruments. Psychomotor subjects with a big share of the cognitive and affective are all instrumental and singing subjects, chamber and orchestral musicianship, choir, conducting, score playing and etc. Here it comes to the principle division of music education on the so-called *theoretical* and *instrumental* programs, and traditionally a variety of content intensity of theoretical subjects for, for example, theoreticians and performers. At the same time, as solfeggio educators, we are facing the eternal dilemma – what is Solfeggio, and what that subject teaches us?

#### *What is Solfeggio?*

The subject Solfeggio as a musical-pedagogical discipline has its educational-learning and functionally-practical aims that are truncated on the process of music literacy, the process of setting specific sound performance, acquisition the skill of voice reproduction of the score, understanding, memorizing and recording musical content. Solfeggio is the subject that by mastering small forms, leads us from intellection through knowledge to comprehension, acquisition, understanding and development of a musical thought, which is considered to be the highlight of cognitive abilities. Understanding, as the inclusion of the new and unknown in a circle of old and familiar, leads to the knowledge that must be permanently and functionally to precede the thinking – thought process of establishing functional relationships. Solfeggio is mandatory subject from the beginning to the end of the music education and involves the adoption of the basic facts of music grammar. It is the subject that involves intelligence, determined by the knowledge fund developing levels, a good musical hearing, attention, concentration and talent. Stratification and complexity of musical art directly reflects on the complexity of solfeggio teaching. The adoption of terms, phenomena and the rules of music are achieved through the process of working on music literacy and later, through correlation of solfeggio teaching with instrumental teaching, but also counterpoint, harmony, musical forms and styles.

Complex cognitive process of adopting

a music language ranges from the adoption of the individual musical terms to the ability of standalone analysis of the musical piece or music composing.

The aim of teaching is to direct musical knowledge of every instrumentalist to understanding music language, while, on the other hand, the content of theoretical subjects directs more towards practical, performance outcome.

In the initial levels of education can be talking about separate areas until later the area of understanding composition, virtuoso technical performance and built aesthetically attitude towards composition merge.

Specifically, in solfeggio teaching gradually stratification of relations of musical horizontal and vertical from simple to virtuoso is achieved through gradual movement from theoretical to practice, and it is best reflected in the two disciplines – dictation recording and singing *prima vista* examples. The first time reading the score is called Sight-reading by musicians (ital. *prima vista* which means at first glance).

More precisely, these two disciplines in a small form contain above mentioned levels, from hear recognition of intonation and rhythmic terms to their use represent the highest level of cognitive understanding music language (score), and they're almost not associated with the level of playing technique.

During these processes, two pedagogical orientations are always present: one, which puts the emphasis on empowering music vocabulary by practicing melodic / rhythmic / harmonic and technical elements, and the other, that puts focus on understanding music flow and content, expressivity and musically performance (Bogunović and Vujović, 2012). *Sight reading* can be defined as “the ability of transfer music symbols and marks in interpretation during a strict time limit” (Stauffer, 2005:21). The ability to *sight read* represents a reliable method of auditive internalization. When this skill is established, acquired auditive knowledge can be transferred to the instrument. Surveys have shown that exercise of *prima vista* examples leads to the skill improvement in every aspect of music (Beck, Surnami and Lewis, 2004: 5). To establish a connection between the performance and auditive skills, the understanding, which is highlighted as a comprehensive request of musical interpretation, is necessary.

Understanding is achieved through the three main activities: Improvisation and playing by ear, memory and kinesthesia. Impro-

visation helps to understand the role between the active-hearing perception and intellection. The skill of improvisation, thereby, depends on the effective use of memory. Musical memory, as skill integrated with the development process of musical involves long-term ability of maintenance and recognition of music material which was previously experienced by perception (Cvetković-Crvenica, 2017). This skill is improved through perception and dictations.

#### *Musical knowledge and transfer of learning*

Given the fact that subject Solfeggio represents a combination of practical and theoretical elements, concrete practical and abstract intellectual skills, the existence of potential for their transfer and use in different situations is necessary. Regarding this, the question arises – whether, and to what extent, the skills acquired in the solfeggio teaching function as a predictor of success in other musical areas, in particular the field of instrumental performance?

Transfer of learning (Term origin: from the Latin verb *transfere* – to transmit. To transmit means the transfer of the effect of one learning to another learning or activity; it is the use of previously acquired experience, or the repetition of certain behaviors in new situations.) is considered a base of reflective and abstract thought (Haskell, 2001) which overcomes almost all learning domains and it happens when the skills acquired in a particular area generalize on the new areas or enhance the general cognitive abilities (Sala and Gobet, 2017). The transfer of learning occurs when a person applies knowledge or skills taught in one context to a new context. The development of students' transversal competences is directly related to the use of the cognitive abilities for learning and interpreting knowledge developed to the level of skills (Tsankov, 2017). Researchers who are interested in the transfer of are initially guided by theories that highlight the similarities between the initial experience of learning and subsequent learning. The transfer is seen as the desirable goal in the process of learning today, and the music is one of the specific aspects of this complex and a broad research field.

Although researches of music abilities are carried out decades ago, regularly tracking their development in educational practices requires further research. In order to find out the possibility of transferability of musical skills acquired in the solfeggio teaching in the frame of instrumental teaching, we designed

the questionnaire that reflects the attitudes of students according to certain areas of work in the solfeggio teaching and their influence on instrumental performance.

The paper represents an interdisciplinary research which aims to put in relationship theoretical-practical access of music pedagogues in solfeggio teaching based on methods, techniques and procedures of acquiring specific aspects of musical performance, with other theoretical and practical subjects and cognitive aspect of understanding and awareness as an integrated part of musical training.

This widely concept includes the entire skill complex, starting with sight reading, performing music, playing by heart and ear and improvisation (McPherson, 1997) to the entire spectrum of professional and personal skills including hearing, cognitive, technical, musically expressive, performing and learning skills (Hallam, 2006). Since the studying of music includes long periods of focused attention, every day practice, musical notation reading, memorizing long music units, learning about different musical structures, acquiring technical skills and emotional expression during performance, there are a number of reasons that affect the uniqueness of above mentioned transfers. Connectivity of the success of knowledge, playing and singing points to the transfer of musical knowledge and skills from one area of musical competencies to the other and accumulation of those competencies.

This combination of experiences can have a positive impact on the cognition, especially during childhood, when the brain development is high plastic and sensitive for the impact of the environment (Schellenberg, 2004). The conclusion exported out of this is that musical knowledge can be acquired only with actively engagement. The active position of the students is emphasized in order to improve their own abilities and also the quality of teaching (Galustyan, 2017). And while for to sing a crucial is level of musical skills, students can overcome playing by adoption of a musical knowledge and the acquisition of singing skills with the lower levels of musical abilities, relying on understanding of musical structure in notational record and motor segment of playing.

The characteristics of the process of learning music that can lead to a distant transfer of musical knowledge and skills on the other cognitive abilities are decoding visual information into motor activity, memorizing and learning musical structures and the rules, learning how to do a fine spectral and temporal

discrimination and learning of performing fine bimanual movements (Norton et al., 2005).

The primary aim of the research was to determine the attitudes of the students of the Department of Music Art from the Faculty of Arts in Niš according to musical skills acquired in solfeggio teaching, in the context of their impact on the instrumental performance. We have taken on the assumption that the advancement of musical skills acquired in the solfeggio teaching has a positive impact on the field of instrumental performance and leads to the development of musical potential, that is the development of musical skills, both the level of sensory abilities and the level of understanding music structures. We were interested in finding student's perceptions of transferability of musical skills acquired in solfeggio teaching into the framework of instrumental teaching and performance. In order to obtain empirical and quantitative results of research and analysis of student's attitudes, a questionnaire survey was conducted for this occasion with tasks related to the need to determine: student attitude towards the valuation of various components of instrumental performance; correlation of solfeggio and instrumental teaching and the importance of work on certain elements within the solfeggio teaching; towards valuation of expressive elements in relation to the technical skills in the solfeggio teaching. The basic hypothesis relates to the impression that students express a high level of awareness of the close connection between the solfeggio and instrument teaching, equally valuing the work in every area of the solfeggio teaching. They are also aware of the importance of the continuous exercise of expressive elements and technical skills within solfeggio teaching.

## 2. MATERIALS AND METHODS

The research was conducted on a sample (N=52) of Bachelor students of the Department of Music Art from the Faculty of Arts in Niš. The realization of the research was carried out in November of the academic 2018/2019. year. Among them there were mostly (23/44.2%) first year students, 16 (30.8%) students of the second year, 12 (23.1%) students of the third year, while the student of the fourth year (1/1.9%) were in the least. The representativeness of the sample was achieved by the choice of several age groups of higher education respondents, and the difference of one year between each group provided an insight into

the broader range of the age structure. The research was based on the descriptive method.

For the purposes of the research, a questionnaire, which first part includes questions pertaining to gender, year of the study and the department which students attend, was constructed and applied. The processing of the received data was performed in the statistical package *IBM SPSS Statistics 20.0*. As far as descriptive statistics are concerned, frequencies (f) and percentages (%) were used. For statistical analysis purposes a non-parametric Chi-square test was used.

## 3. RESULTS

The first research task was to check the student's opinion on the components that influence the success of the instrumental performance. Deciding on one of the three responses offered – 1 *inborn abilities*, 2 – *acquired abilities*, 3 – *both*, out of the total number of respondents, 46.2% believe that the successful instrumental performance requires the sharing of inborn and acquired abilities, then the acquired skills (38.5%), while the relatively small number of students (15.4%) think that effective instrumental performance is influenced by innate abilities (Table 1).

**Table 1.** Student's attitudes about abilities that influence successful instrumental performance

	Inborn abilities	Acquired abilities	I agree with both	Total
F	8	20	24	52
P	15.4	38.5	46.2	100.0
<b>CP</b>	<b>15.4</b>	<b>38.5</b>	<b>46.2</b>	<b>100.0</b>

The results of the *Chi-square* test (Table 2) show that there is not a significant statistical difference in student's attitudes in relation to the year of study ( $\chi^2=5.074$ ;  $df=6$ ;  $p=0.534$ ).

**Table 2.** Student's attitudes about abilities that influence successful instrumental performance in relation to the year of study

Study year	Inborn abilities	Acquired abilities	I agree with both	Total
First	3 5.8%	11 21.1%	9 17.3%	23 100.0%
Second	2 3.8%	4 7.7%	10 19.2%	16 100.0%
Third	3 5.8%	4 7.7%	5 9.6%	12 100.0%
Fourth	0 0.0%	1 1.9%	0 0.0%	1 100.0%
<b>Total</b>	<b>8 15.4%</b>	<b>20 38.5%</b>	<b>24 46.1%</b>	<b>52 100.0%</b>

$\chi^2=5.074$   
df=6  
p=0.534

In the second question, students were asked to assess the most valued performance characteristic on scale from 1 to 5. Features include: *expressiveness*, *personal style*, *stage performance*, *technical skills* and *theoretical knowledge*. On the basis of the results obtained, the most evaluated characteristics

were: *expressiveness* (75.0%), *technical skills* (55.8%) and *personal style* (53.8%), while the characteristics of minor importance according to the opinion of students are *stage performance* (36.5%) and *theoretical knowledge* (25.0%) (Table 3).

**Table 3.** Student's attitudes about the evaluation of the performance characteristics

	1	2	3	4	5	Total
<b>Expressiveness</b>	1 1.9%	2 3.8%	2 3.8%	8 15.4%	39 75.0%	52 100.0%
<b>Personal style</b>	1 1.9%	2 3.8%	8 15.4%	13 25.0%	28 53.8%	52 100.0%
<b>Stage performance</b>	1 1.9%	2 3.8%	17 32.7%	13 25.0%	19 36.5%	52 100.0%
<b>Technical style</b>	1 1.9%	1 1.9%	3 5.8%	18 34.6%	29 55.8%	52 100.0%
<b>Theoretical knowledge</b>	4 7.7%	8 15.4%	14 26.9%	13 25.0%	13 25.0%	52 100.0%

Answers to the following question illuminated student's attitudes about the most significant factors that influence the way of interpretation of a musical piece (*acquired knowledge and skills*, *composer's intention*, *music by itself*, *character of the piece*, *personal emotions and feelings*), where 1 is – *very important factor*, 2 – *not important factor at all*, 3 – *I might be an important factor*. Based on the obtained average values we can notice that students highly evaluate all of the mentioned factors, with minimal difference in percent. Factor *acquired knowledge and skills* is marked as a very important factor by 88.5% of respondents, *character of the piece* 80.8%, *music by itself* 61.5%, while factors *composer's intention* and *personal emotions* are rated as very important factor by 88.5% of respondents (Table 4).

**Table 4.** Student's attitudes about the most significant factors that influence the way of interpretation of a musical piece

	Very important factor		Not important factor at all		It might be an important factor		Total	
Acquired knowledge and skills	46	88.5%	4	7.7%	2	3.8%	52	100.0%
Composer's intention	31	59.6%	6	11.5%	15	28.8%	52	100.0%
Music by itself	32	61.5%	4	7.7%	16	30.8%	52	100.0%
Character of the piece	42	80.8%	4	7.7%	6	11.5%	52	100.0%

The next research task was aimed at the information on which components respondents first pay attention to during the first encounter with a melodic exercise. The task offered responses are 1 – *melodic line*, 2 – *tempo*, 3 – *dynamics*, 4 – *time signature*, 5 – *phrasing*, 6 – *composer*. The results in Table 5 show that most of the respondents first pay attention to *melodic line* (34.6%) and *time signature* (17.3%). During the first encounter with a melodic exercise 13.5% of respondents first pay attention to *tempo*, 5.8% to *phrasing*, 3.7% to *composer*, while the answer *dynamics* circled 1.9% of respondents. Respondents also showed the ability to perceive multiple different components during the first encounter with a melodic exercise. Within multiple responses the *melodic line and time signature* (11.5%) and *melodic line, tempo, dynamics and time signature* (9.6%) were singled out, and a 1.9% of respondents first pay attention to *melodic line and tempo*.

**Table 5.** What is the first thing you pay attention to during the first encounter with a melodic exercise?

	F	P	CP
Melodic line	18	34.6	34.6
Tempo	7	13.5	48.1
Dynamics	1	1.9	50.0
Time signature	9	17.3	67.3
Phrasing	3	5.8	73.1
Composer	2	3.8	76.9
Melodic line and time signature	6	11.5	88.5
Melodic line and tempo	1	1.9	90.4
Melodic line, tempo, dynamics and time signature	5	9.6	100.0
<b>Total</b>	<b>52</b>	<b>100.0</b>	<b>100.0</b>

The next question had an aim to examine which area of solfeggio contributes the most to the advancement of instrumental performance. The respondents could circle one or more area from three offered: *melodic*, *rhythm* and *music theory*. Based on the obtained average values it can be seen that respondents believe that *melodic* and *rhythm* are the areas that equally contribute to the advancement of instrumental performing (*melodic* – 48.1%, *rhythm* 46.1%), while for the area *music theory* opted 5.8% of respondents (Table 6).

**Table 6.** Student's attitudes about which area of solfeggio contributes the most to the advancement of instrumental performance

	Melodic	Rhythm	Music theory	Total
F	25	24	3	52
P	48.1	46.1	5.8	100.0
<b>CP</b>	<b>48.1</b>	<b>46.1</b>	<b>5.8</b>	<b>100.0</b>

The results of the *Chi-square* test (Table 7) show that there is not a significant statistical difference in student's attitudes in relation to the year of study ( $\chi^2=8.531$ ;  $df=15$ ;  $p=0.901$ ).

**Table 7.** Student's attitudes about which area of solfeggio contributes the most to the advancement of instrumental performance in relation to the year of study

Study year	Melodic		Rhythm		Music theory		Total		
First	11	21.1%	11	21.1%	1	1.9%	23	100.0%	
Second	8	15.4%	7	13.5%	1	1.9%	16	100.0%	$\chi^2=8.531$
Third	5	9.6%	6	11.5%	1	1.9%	12	100.0%	df=15
Fourth	1	1.9%	0	0.0%	0	0.0%	1	100.0%	p=0.901
<b>Total</b>	<b>25</b>	<b>48.1%</b>	<b>24</b>	<b>46.1%</b>	<b>3</b>	<b>5.8%</b>	<b>52</b>	<b>100.0%</b>	

The following question examined the student's opinion on skills of instrumental performance that are advanced in solfeggio teaching. Offered skills are *sight reading*, *performing practiced music*, *playing by heart*, *playing by ear* and *improvisation*. Obtained average values show that student's opinion is mostly agreed. Namely, 48.1% respondents consider that in solfeggio teaching the skill of sight reading is advanced, 17.7% declared for the answer *sight reading and playing by ear*, while the skills *performing practiced music*, *playing by ear* and *sight reading and performing practiced music* are included with 7.7% each (Table 8). Gained results give better insight into student's reflections and their attitude about particular skills that are acquired in solfeggio teaching.

**Table 8.** Which skills of instrumental performance are advanced in solfeggio teaching?

	F	P	CP
Sight reading	25	48.1	48.1
Performance of practiced music	4	7.7	55.8
Playing by ear	4	7.7	63.5
Sight reading and playing by ear	9	17.3	80.8
Sight reading and performance of practiced music	4	7.7	88.5
All mentioned	6	11.5	100.0
<b>Total</b>	<b>52</b>	<b>100.0</b>	<b>100.0</b>

The next research task was aimed to determine the student's attitudes about the importance of work on some elements in the

framework of solfeggio teaching. Within these questions students showed their attitude by choosing one of a five offered statements (*very important* – 1, *important, but not crucial* – 2, *classes can be carried out without this segment/can be excluded* – 3, *not important at all* – 4, *I have no opinion* – 5).

First question within this research task examined the student's attitudes about the importance of work on melodic. Based on the obtained average values, the respondents highly evaluated work on melodic. Out of a total number of respondents 53.8% consider the work on melodic very important, 42.3% agrees with the statement that work on melodic is important, but it is not of a crucial importance, while only 3.8% believe that solfeggio teaching classes can be carried out without this segment (Table 9).

**Table 9.** Student's attitudes about the importance of work on melodic

	Very important	Important, but not crucial	Can be excluded	Not important at all	I have no opinion	Total
F	28	22	2	0	0	52
P	53.8	42.3	3.8	0.0	0.0	100.0
CP	53.8	96.2	3.8	0.0	0.0	100.0

By comparing data with a variable *Year of study*, and based on the results of *Chi-square* test we can notice that there is not a significant statistical difference in student's attitudes in relation to the year of study ( $\chi^2=7.227$ ; df=6; p=0.300). No matter what, it can be seen that the answer *can be excluded* was chosen by students of first and second study year, which confirms the fact that attitudes are positively changing with the age.

**Table 10.** Student's attitudes about the importance of work on melodic in relation to the year of study

Study year	Very important	Important, but not crucial	It can be excluded	Not important at all	I have no opinion	Total
First	9 17.31%	13 25.0%	1 1.9%	0 0.0%	0 0.0%	23 100.0%
Second	12 23.1%	3 5.8%	1 1.9%	0 0.0%	0 0.0%	16 100.0%
Third	6 11.5%	6 11.5%	0 0.0%	0 0.0%	0 0.0%	12 100.0%
Fourth	1 1.9%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	1 100.0%
<b>Total</b>	<b>28 53.9%</b>	<b>22 42.3%</b>	<b>2 3.8%</b>	<b>0 0.0%</b>	<b>0 0.0%</b>	<b>52 100.0%</b>

In the framework of the work on melodic, a question was raised regarding the attitude of the students about the importance of performing *prima vista* examples. Students recognize the importance of practicing these examples and highly value this segment of teaching, as evidenced by the following results: *very important* – 32.7%, *important, but not crucial* – 55.8%, *it can be excluded* – 5.8%, *not important at all* – 1.9%, *I have no opinion* – 3.8% (Table 11).

**Table 11.** Student's attitudes about the importance of performing *prima vista* examples

	Very important	Important, but not crucial	It can be excluded	Not important at all	I have no opinion	Total
F	17	29	3	1	2	52
P	32.7	55.8	5.8	1.9	3.8	100.0
<b>CP</b>	<b>32.7</b>	<b>55.8</b>	<b>5.8</b>	<b>1.9</b>	<b>3.8</b>	<b>100.0</b>

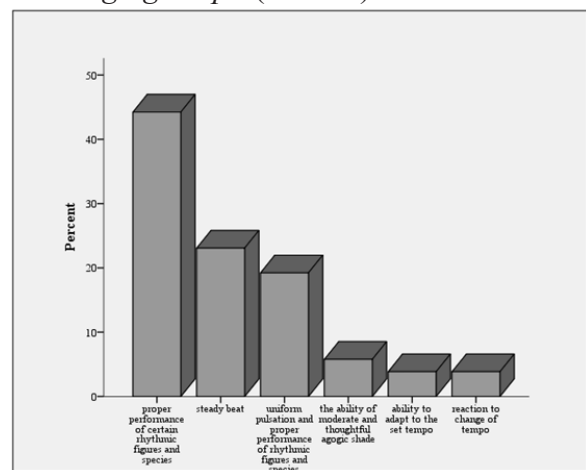
Work on rhythm (Table 12) was also highly evaluated by respondents (*very important* 92.3%, *important, but not crucial* 7.7%).

**Table 12.** Student's attitudes about the importance of work on rhythm

	Very important	Important, but not crucial	It can be excluded	Not important at all	I have no opinion	Total
F	48	4	0	0	0	52
P	92.3	7.7	0.0	0.0	0.0	100.0
<b>CP</b>	<b>92.3</b>	<b>7.7</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>100.0</b>

With the next question we were overwhelmed on rhythm area by questioning student's attitudes about the performance ability that they consider to be the most related to work on rhythm within solfeggio teaching. The respondents expressed their attitudes by rounding off one or more abilities from five offered: *steady beat*, *ability to adapt to the set tempo*, *reaction to changing tempo*, *proper performance of certain rhythmic figures and*

*species and ability of moderate and thoughtful agogic shading*. Based on the obtained average values it was determined that almost half out of a total number of respondents selected the answer *proper performance of certain rhythmic figures and species* (44.2%), 23.1% *steady beat* 19.2% respondents selected multiply answer *uniform pulsation and proper performance of certain rhythmic figures and species*. So, most of them believe that solfeggio teaching advances primary these two abilities. Ability of *moderate and thoughtful agogic shading* was chosen by 5.8% respondents, while 3.8% of them consider that with in solfeggio teaching advances the *ability to adapt to the set tempo and ability of reaction to changing tempo* (Chart 1).



**Chart 1.** Which performance ability you consider to be the most related to work on rhythm within solfeggio teaching?

Based on the analysis of the obtained average values for questions concerning the importance of manual performing exercises by taping, singing melodic with the taping of a rhythmic section, and the work on two-handed taping, we realize that respondents agree that these teaching segments are important, but that they are not of crucial importance (Table 13).

**Table 13.** Student's attitudes about the importance of work on certain segments in the rhythm area

Student's attitudes about the importance of manual performing rhythmic exercises by taping						
	Very important	Important, but not crucial	It can be excluded	Not important at all	I have no opinion	Total
F	11	24	13	1	3	52
P	21.2	46.2	25.0	1.9	5.8	100.0
<b>CP</b>	<b>21.2</b>	<b>67.3</b>	<b>92.3</b>	<b>94.2</b>	<b>100.0</b>	<b>100.0</b>
Student's attitudes about the importance of work on singing melodic with the taping of a rhythmic section						
F	9	22	18	2	1	52
P	17.3	42.3	34.6	3.8	1.9	100.0
<b>CP</b>	<b>17.3</b>	<b>59.6</b>	<b>94.2</b>	<b>98.1</b>	<b>100.0</b>	<b>100.0</b>
Student's attitudes about the importance of work on two-handed taping						
F	6	18	23	2	3	52
P	11.5	34.6	44.2	3.8	5.8	100.0
<b>CP</b>	<b>11.5</b>	<b>46.2</b>	<b>90.4</b>	<b>94.2</b>	<b>100.0</b>	<b>100.0</b>

The next question referred to the area of work on dictations. Based on the results on importance of work on melodic dictations it can be seen that students highly evaluate this segment of work, since 57.7% respondents consider this segment as a very important. Besides, attitudes have been agreed, so study year does not have statistical significance or impact to the final result (Tables 14 and 15).

**Table 14.** Student's attitudes about the importance of work on melodic dictations

	Very important	Important, but not crucial	It can be excluded	Not important at all	I have no opinion	Total
F	30	16	3	0	3	52
P	57.7	30.8	5.8	0.0	5.8	100.0
<b>CP</b>	<b>57.7</b>	<b>88.5</b>	<b>94.2</b>	<b>0.0</b>	<b>100.0</b>	<b>100.0</b>

**Table 15.** Student's attitudes about the importance of work on melodic dictations in relation to the year of study

Study year	Very important		Important, but not crucial		It can be excluded		Not important at all		I have no opinion		Total		
First	14	26.9%	4	7.7%	2	3.8%	0	0.0%	3	5.8%	23	100.0%	
Second	10	19.2%	6	11.5%	0	0.0%	0	0.0%	0	0.0%	16	100.0%	$\chi^2=9.514$
Third	5	9.6%	6	11.5%	1	1.9%	0	0.0%	0	0.0%	12	100.0%	df=9
Fourth	1	1.9%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	100.0%	p=0.391
<b>Total</b>	<b>30</b>	<b>57.7%</b>	<b>16</b>	<b>30.1%</b>	<b>3</b>	<b>5.8%</b>	<b>0</b>	<b>0.0%</b>	<b>3</b>	<b>5.8%</b>	<b>52</b>	<b>100.0%</b>	

When it comes to the rhythmic dictations, average values show lower evaluating of this segment, since half of respondents expressed the opinion that work on rhythmic dic-

tations is important, but not crucial (Table 16).

**Table 16.** Student's attitudes about the importance of work on rhythmic dictations

	Very important	Important, but not crucial	It can be excluded	Not important at all	I have no opinion	Total
F	14	26	7	1	4	52
P	26.9	50.0	13.5	1.9	7.7	100.0
CP	26.9	76.9	90.4	92.3	100.0	100.0

Evaluating the importance of work on improvisation and practicing examples from artistic literature, respondents highly evaluated first segment, but believing that it is not of a crucial importance (Table 17), while work on examples from artistic literature is valued as a very important segment by 46.2% respondents (Table 18), which is in accordance with the study program they attend.

**Table 17.** Student's attitudes about the importance of work on improvisation

	Very important	Important, but not crucial	It can be excluded	Not important at all	I have no opinion	Total
F	8	27	12	3	2	52
P	15.4	51.9	23.1	5.8	3.8	100.0
CP	15.4	67.3	90.4	96.2	100.0	100.0

**Table 18.** Student's attitudes about the importance of work on examples from artistic literature

	Very important	Important, but not crucial	It can be excluded	Not important at all	I have no opinion	Total
F	24	15	11	1	1	52
P	46.2	28.8	21.2	1.9	1.9	100.0
CP	46.2	75.0	96.2	98.1	100.0	100.0

The last research task referred to evaluating expressive elements in relation to technical skills within solfeggio teaching (Table 19). On question *Do you, within solfeggio teaching, give the advantage to: 1 – expressive elements, 2 – technical skills, 3 – I have no opinion, 4 – expressive elements and technical skills?* half of them gave equal importance to both of the abilities, which supports the claim that students at this level of study have a developed awareness of the importance of linking the technique and expression.

**Table 19.** Expressive elements or technical skills?

	Very important	Important, but not crucial	It can be excluded	Not important at all	I have no opinion	Total
F	8	11	7	26	52	8
P	15.4	21.2	13.5	50.0	100.0	15.4
CP	15.4	36.5	50.0	100.0	100.0	15.4

## 4. DISCUSSIONS

Our research has studied student's attitudes about possible reflection of the solfeggio teaching content and skills acquired within it.

Students' opinion on the components that affect the success of an instrumental performance (almost half of them believe that successful instrumental performance requires sharing of innate and acquired abilities) speaks to their awareness that talent is an important factor, but that continuous acquisition and mastering skills is necessary for successful performance (Table 1).

One reads from Table 2 that there is not a significant statistical difference in student's attitudes in relation to the year of study, which implies that students at all levels of the study are aware that inborn abilities affect the instrumental performance, but that success undoubtedly depends on the acquired skills as well.

The results from Table 3 show that students' attitudes are in line with the study program they attend.

From Table 4 we can conclude that respondents at this level of knowledge express a high level of awareness of the importance of different factors and characteristics and their impact on successful instrumental performance.

The fact that students highly evaluate all of the mentioned factors that influence the way of interpretation of a musical piece (Table 4) undoubtedly indicates that students at this level of education are aware of the delicacy of instrumental performance, which depends on the synergy of many factors.

By analyzing Table 5 we find that during the first encounter with melodic exercise most of the students first pay attention to the melody line (34.6%) and time signature (17.3%), which is important information about their perception experience. We think that these attitudes were influenced by prior schooling, in which the habit of simultaneously observing multiple components is not sufficiently developed.

Tables 6 and 7 show that students place theory in a subordinate position relative to practice, without statistical significance in relation to the year of study. In their view *melodic* (48.1%) and *rhythm* (46.1%) are the areas that equally contribute to the advancement of instrumental performing, while for the area *music theory* opted 5.8% of respondents.

Based on the results from Table 8 we can see that students agree that within solfeggio

gio teaching advances the skill of sightreading. The results also show the awareness of respondents about the importance of correlation of instrumental performance with solfeggio teaching and their pervasion.

In the next research task students expressed their attitudes about the importance of work on some elements in the framework of solfeggio teaching. Students showed positive attitudes towards work on some elements in the framework of solfeggio teaching (Tables 9-18). The answers of evaluation were mostly either *Very important or Important, but not crucial*. Positive attitudes confirm the initial hypothesis and provide insight into teaching practice.

The results from the last research task, which referred to evaluating expressive elements in relation to technical skills within solfeggio teaching (Table 19) reaffirm the importance of the need for synergy of expressive elements and technical skills and student's awareness of it.

The overall results confirm the hypothesis that students express high awareness of the narrow connectivity of solfeggio and instrumental teaching, equally evaluating work in all areas of solfeggio teaching. They also showed positive attitudes about a possible reflection of the solfeggio teaching content and skills that are acquired in it, as well as there's a high degree of the use of skill acquired in solfeggio teaching in instrumental performance.

## 5. CONCLUSIONS

This paper presents the results of a descriptive pilot study in which quantitative and qualitative analysis was used. Research results indicate the importance of educational experience in shaping the attitudes of students. Students have shown positive attitudes about the possible reflection of the solfeggio teaching content and skills acquired within it, and based on the data analysis it has been found that there is a high degree of use of skills acquired in solfeggio teaching in instrumental performance. The present findings confirmed the actuality of the topic, which is the subject of constant discussions at the level of curriculum and the realized cooperation between solfeggio and instrument teachers. The general conclusion is reduced to the need for a transfer to exist in all domains of musical skills that are represented in solfeggio teaching, while the aims of solfeggio teaching must be set so that they are not isolated and self-sufficient,

but precisely contribute to the development in the field of instrumental music performance. Transfer of learning as one of the basic aims of education must not be adrift. The issue of transferring musical skills from the teaching and linking with the development of the skills of performing demands the joint, cooperative work of teachers and students, which further implies curriculum alignment as an important area for further consideration. For a better understanding of learning transfer and a more complete realization of musical potential, it is essential to extend musical education to the level at which its differentiated activities become integrated in such a way that each of them has the function of empowering others. In this way, the correlation of solfeggio teaching with instrumental education has a prominent role at all levels of music education. It is not meant exclusively for the harmonization of curricula and forcing the study of the theory, but for thinking about vocal and instrumental practice as one discipline.

In order to train students at all levels for quality interpreting and supporting their musical and personal development, contemporary solfeggio teaching must put students in an active relationship with the music they will be able to perform independently. This highlights the role of teachers in the attainment of skills and competences (Bogunović and Mirović, 2014). The significance of properly defined and applied teacher competencies represents a solid foundation for the successful achievement of educational goals and objectives (Nikodinovska Bancotovska, 2015). This research represents a small group effort within the solfeggio teaching of students of Performing Arts at Faculty of Arts of the University in Niš, and is a prerequisite for further research in this field. The incentive and support for this kind of research came from the students themselves, and the research itself has provided practical implications in the process of music education of students, and brought new insights into the subject.

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### Conflict of interests

The authors declare no conflict of interest.

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# TEACHING METHODS USED IN SPECIAL EDUCATION: A CONTENT ANALYSIS STUDY

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## ABSTRACT

This study aims to reveal the situation and trends in teaching methods used in special education. Content analysis and citation analysis were used in this study as a research model. Published documents were obtained from Scopus by using the keywords 'teaching method' and 'special education' and a total number of 63 documents were obtained. The published documents were examined based on the previously determined content analysis criteria involving year of publication, name of the journals, authors, affiliations, countries, document type, subject area, keywords, language and citations. Data were analysed and provided with frequency and percentages. Results generally showed that there is an increase in the number of researches on teaching methods and special education throughout the years, most of the published documents were articles and from the areas of social sciences and psychology. All of the results were discussed with the relevant literature and recommendations for further research and practices were presented.

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## 1. INTRODUCTION

Today's world has been witnessing considerable changes in many fields due to the recent technological advancements. Education is one of these fields that have been notably affected by such developments. The main trend in modern education today is to adopt a student-centred approach in teaching instead of teacher-centred traditional approaches because each student is unique, and their learning styles and capacities greatly differ from each other (Ozbal and Eski, 2019).

The principle of equal opportunity in education is one of the basic priorities of democratic societies and precisely, it is not possible to provide this to students with special needs without providing special education services (Agha and ELDaou, 2018; Ball, 2012; Lynch

and Baker, 2005). Individuals with special needs have different requirements and characteristics from their peers with typical development in terms of physical, social, mental and emotional development. Individuals with special needs might differ significantly from the level expected from his or her age in terms of individual characteristics and educational competence for various reasons (Baglama, Serttas and Demirok, 2017; Bateman and Bateman, 2014).

Fulcher (2015) indicated that there is a need to make legal, administrative and educational arrangements for individuals with special needs to benefit from equal education and life opportunities as individuals with normal developmental characteristics. After the implementation of 'Individuals with Disabilities Education Act' in 1975; it is aimed to ensure that every individual with special needs have the right to benefit from appropriate educational services. In addition, preventing stigmatization of individuals with special needs, evaluation without focusing on differences, preparing individualized education programs, providing a less restricted environment in education, inclusion and ensuring a legal base for these issues were also mentioned and targeted in the implementation of the act (Flanagan,

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1995). Today, every individuals with special needs have the right to receive education as their peers, and mainstreaming and inclusion practices have increased in order to include them in regular education environments to be able to spend time and receive education with their peers, feel as a part of the society and therefore, increase their self-confidence and daily living skills (Cook, Klein and Chen, 2015; Dogan and Bengisoy, 2017; Rajendran, Reddy and Reddy, 2017; Sivrikaya and Yikmis, 2016).

Furthermore, Akcamete (2015) stated that the main purpose of special education services is to provide the independent living skills necessary for individuals to continue their lives in society without being dependent on others. Individuals with special needs require additional support in learning various skills necessary for living in a society independently. These skills might involve self-care, daily living skills, shopping, travelling and functional academic skills such as reading, writing and mathematical skills based on individuals' requirements. Acquisition of these skills is possible with designing and providing the most appropriate content, goals and content for their programmes. Accordingly, it is important to present the content with the appropriate teaching method and approach for the education of individuals with special needs (Argyropoulos, V. and Chamonikolaou, S., 2016; Friend and Bursuck, 2018; Uzunboylu, Kinik and Kanbul, 2017).

The use of correct and effective methods in learning and teaching processes is more important than increasing the student's learning. There are many methods used in learning-teaching processes. What is important is that when the teacher is teaching the content, he chooses the most appropriate and appropriate method for the students' level. As well as general methods, each field has its own methods (Kurt and Yavuz, 2018).

Teaching methods in special education generally aims to gain and/or increase appropriate behaviours and prevent, decrease and/or remove inappropriate behaviours of individuals with special needs in order to maintain their lives independently (Demirok, Meral Karabacak and Aysever, 2019). This could be achieved with applied behavioural analysis approach, which is widely used in special education. At this point, it is important to mention that there are various teaching methods used in special education in which their effectiveness are shown with many scientific research (Mitchell, 2014; Odom et al., 2005; Sue-En-

glert, Tarrant and Mariage, 1992).

When choosing the right and most effective teaching method for individuals with special needs, type of the skills that will be taught, individual characteristics of the child and educational requirements, learning environments and teaching materials and accessibility of support services (Kukeş, Gunes, and Genç, 2019). There are additional teaching methods for gaining various skills to individuals with special needs. Forward chaining, inverse forward chaining and whole skill teaching are some examples for these methods. Physical help, verbal cues, modelling, etc., are also used in teaching individuals with special needs (Bloş et al., 2017). Nevertheless, there are additional teaching methods used in special education involving direct instruction (Bechtolt et al., 2014; Eratay and Yeserioglu, 2017), natural teaching (Wolery, Bailey and Sugai, 1988), computer-assisted education (Bakker, Heuvel-Panhuizen and Robitzsch, 2016; Ozdamli, 2017) and sensory-based teaching (Barton et al., 2015).

Apart from these teaching methods, errorless teaching methods are one of the most broadly used methods in special education. Errorless teaching is an approach developed based on skills and concept teaching is achieved with the positive effect of responses and exercises during teaching instead of the errors during instruction (Wolery, Bailey and Sugai, 1988). This approach emerged because it is noticed that error levels are increased when teaching individuals with special needs through traditional teaching methods. When the error level is decreased with errorless teaching methods, a positive interaction between a learner and a teacher has been established. In skills teaching based on errorless teaching methods, cues are given for the child to display target behaviours and these cues need to be provided based on a systematic plan in order to be effective. Therefore, many different methods were developed related with the use of cues. These methods involve increasing the cue, increasingly reducing the cue, simultaneous prompting, incremental cue, increased waiting time, pre-behaviour cue and test, pre-behaviour cue and cue retraction and fixed waiting time (Braga-Kenyon et al., 2017; Sorakin and Uzunboylu, 2017; Tekin-Iftar and Kircaali-Iftar, 2013).

It is essential for individuals with special needs to use accurate, appropriate and effective teaching methods and approaches. As it can be understood, there are various teaching methods used in special education. When the literature is examined, it is seen that the

number of studies were providing a review for prevalently used effective teaching methods in special education. Therefore, this study aims to reveal the situation and trends in teaching methods and special education. It is expected that this study would provide a guidance for researchers and teachers about which teaching methods are used in special education and which of them are more beneficial and effective.

investigating the frequency, patterns, trends and graphs of citations in a group of documents (Moed, 2006). Published documents in Scopus, which is one of the most prestigious databases (Ozkan and Uzunboylu, 2017) were examined in this study. The published documents were obtained through searching keywords ‘teaching method’ and ‘special education’ in order to reveal the current situation and trends in this area.

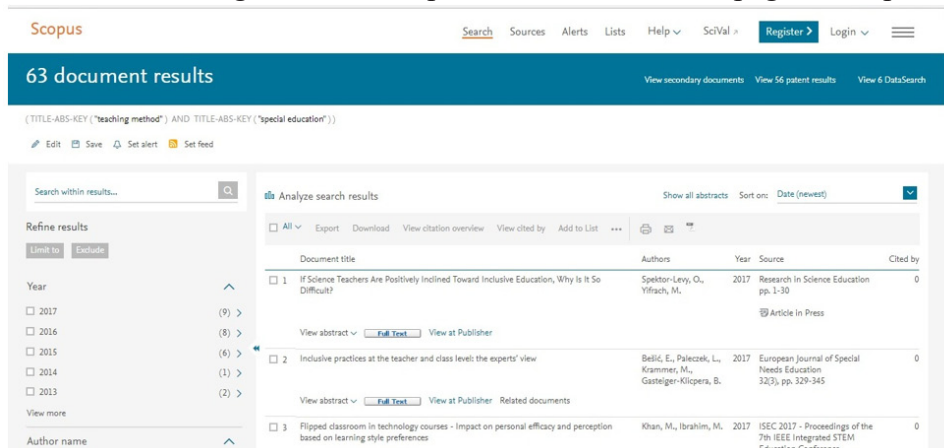
## 2. MATERIALS AND METHODS

Content analysis and citation analysis were used in this research as a research model. Content analysis is a qualitative research method which involves the objective and systematic analysis of verbal, written or other materials (Deepaen, 2016; Tavsancil and Aslan, 2001). Citation analysis is a method of

### 2.1. Data collection

Data of the current study included the published documents on teaching methods in special education in Scopus database between the years of 1975–2017. These articles were searched by the researchers and a total number of 83 articles were obtained at the end of the data collection.

**Figure 1.** The teaching method and special education search page in Scopus



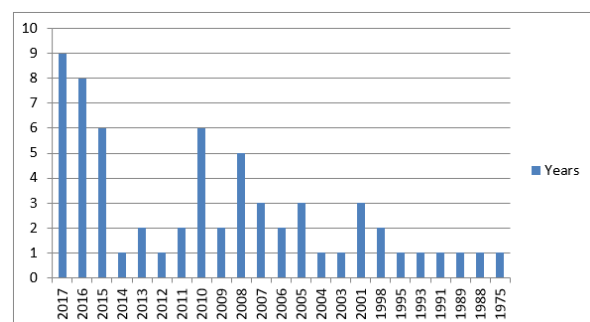
### 2.2. Data analysis

In data analysis, content analysis criteria were determined to examine the published documents in Scopus database. These criteria included year of publication, name of the journals, authors, universities, countries, document type, subject area, keywords, language and most cited documents.

## 3. RESULTS

A total number of 63 articles were examined based on the review of Scopus. Results were interpreted based on the content analysis criteria and discussed with relevant research from the literature.

### 3.1. Distribution of the articles based on the year of publication



**Figure 2.** Distribution of the articles based on the year of publication

As it can be seen, Figure 2 shows the distribution of the articles on teaching methods used in special education based on the year of publication in Scopus database. The years between 1976 and 1988 are not included in the figure, since there were no publications

on teaching methods and special education in these years. Results showed that there are nine articles published in 2017., eight articles in 2016. and six articles in 2015. throughout the 63 articles analysed in the study. Therefore, it can be said that there is a regular increase in the number of publications related with teaching methods used in special education.

### 3.2. Distribution of the articles based on the name of the journals

**Table 1.** Name of the journals in which the articles published

Journal name	<i>f</i>	%
<i>European Journal of Special Needs Education</i>	3	4.76
<i>Asia Pacific Disability Rehabilitation Journal</i>	2	3.17
<i>Egitim ve Bilim (Education and Science)</i>	2	3.17
<i>International Journal of Special Education</i>	2	3.17
Other journals	54	85.72
Total	63	100

Distribution of the articles based on the name of the journals is shown in Table 1. Since there was only one publication in 44 journals, they are not provided in the table and the highest four journals are shown. As it can be seen, the highest number of publication is in European Journal of Special Needs Education ( $f = 3, 4.76\%$ ); Asia Pacific Disability Rehabilitation Journal, Egitim ve Bilim (Education and Science) and International Journal of Special Education have two publications related with teaching methods and special education.

### 3.3. Results on the authors of the articles and their affiliations

Results regarding the authors of the articles and their affiliations were not shown as table or figure, since each author published documents once in the area and it would not be possible to be able to illustrate this in a table or figure. This result might be because the area is new and authors published on teaching methods and special education in Scopus have not specified an expertise yet. In addition, this might be also related with the fact that special education is an interdisciplinary field and authors from different disciplines might have published the articles. According to the results, Bar-Ilan University and Beit Berl Academic

College are the top two academic institutions mentioned as affiliations in the articles and the remaining affiliations were only with one frequency. These results suggested that there is no steady trend in the affiliations of authors.

### 3.4. Distribution of the articles based on the countries

**Table 2.** Articles and their countries

Countries	<i>f</i>	%
United States	19	30.15
Israel	8	12.69
Turkey	5	7.94
Brazil	3	4.76
Malaysia	3	4.76
Taiwan	3	4.76
Belgium	2	3.17
Denmark	2	3.17
Germany	2	3.17
United Kingdom	2	3.17
Other countries	14	22.22
Total	63	100

In Table 2, distribution of the articles based on the countries of the researchers is provided and the top 10 countries were mentioned in the table and the others with one frequency were not included. There were a total number of 31 countries which have been indicated as the countries of the authors. According to Table 3, it can be seen that most articles have been published by the authors from the United States ( $f = 19, 30.15\%$ ) and as the second frequent country of the authors, there were eight authors from Israel (12.69%) and there were five authors from Turkey ( $f = 5, 7.94\%$ ). Besides, there were three authors from Brazil, Malaysia and Taiwan ( $f = 3, 4.76\%$ ) and two authors were from Belgium, Denmark, Germany and the United Kingdom ( $f = 2, 3.17\%$ ). The other remaining countries constituted the 77.78% with one publication from each country.

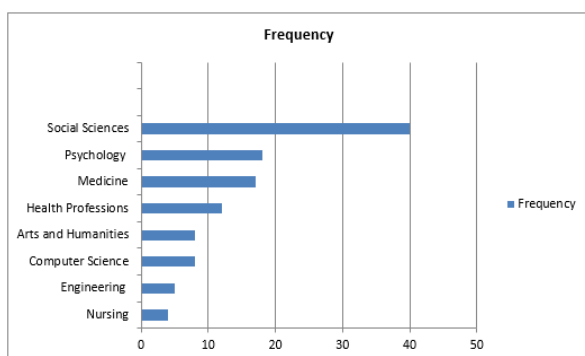
### 3.5. Distribution of the published documents based on the document type

**Table 3.** Document types of the published documents

Document type	<i>f</i>	%
Article	46	73.01
Conference paper	9	14.29
Review	4	6.35
Book chapter	2	3.17
Article in press	1	1.59
Short survey	1	1.59
<b>Total</b>	<b>63</b>	<b>100</b>

Table 3 shows the distribution of the published documents based on the document type. Results indicated that most of the published documents were articles ( $f = 46$ , 73.02%). According to this result, it can be inferred that authors prefer to publish research articles. Besides, nine of the published documents were conference papers (14.29%), four of them were reviews (6.35%), two of them were book chapters (3.17%) and the remaining two published documents were article in press and short survey (1.59%).

### 3.6. Distribution of the articles based on the subject area

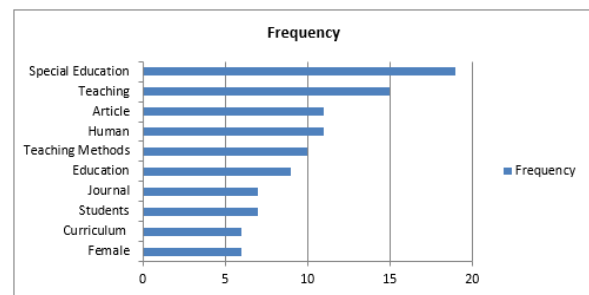


**Figure 3.** Frequency distribution of the articles based on the subject area

Figure 3 shows the distribution of the articles based on the subject area. As it can be seen, social sciences were the most studied subject area with 40 published documents. Results showed that there were 18 published documents from the area of psychology, 17 published documents from the area of medi-

cine, 12 published documents from the area of health professions, eight published documents from the area of arts and humanities and computer Science, five published documents from the area of engineering and four published documents from the area of nursing.

### 3.7. Distribution of the articles based on the keywords



**Figure 4.** Keywords used in the published documents

Figure 4 shows the distribution of the articles based on the keywords mentioned in the published documents. The top 10 keywords obtained from the published documents were included in the figure. According to the results, it can be inferred that ‘special education’ is the most used keyword in the published documents related with teaching methods and special education in Scopus database. This result is followed by ‘teaching’, ‘article’, ‘human’ and ‘teaching methods’. In addition, ‘education’, ‘journal’, ‘students’, ‘curriculum’ and ‘female’ were the other mostly used keywords in the published documents. Therefore, it can be said that, there are various keywords used in the published documents and ‘special education’ as the relevant field was the most used keyword.

### 3.8. Distribution of the articles based on the language

**Table 4.** Language of the published documents

Language	<i>f</i>	%
English	56	88.90
Portuguese	3	4.76
French	2	3.17
Turkish	2	3.17
<b>Total</b>	<b>63</b>	<b>100</b>

Language of the published documents were three documents written in Portuguese, are shown in Table 4. As it can be seen, most two documents in French and two documents of the published documents were written in English (f = 56, 88.90%). In addition, there were two documents in Turkish.

### 3.9. The most cited documents on teaching methods and special education in Scopus

**Table 5.** Most cited documents

No.	Document title	Author(s)	Year	Source	Cited by
1.	Following the child's lead when teaching nouns to preschoolers with mental retardation	Yoder, P.J., Kaiser, A.P., Alpert, C., Fischer, R.	1993	<i>Journal of Speech and Hearing Research</i> , 36(1), pp. 158-167.	49
2.	Inclusion and burnout in physical education	Fejgin, N., Talmor, R., Erlich, I.	2005	<i>European Physical Education Review</i> 11(1), pp. 29-50	25
3.	Brief report: Outcomes of a teacher training program for autism spectrum disorders	Probst, P., Leppert, T.	2008	<i>Journal of Autism and Developmental Disorders</i> 38(9), pp. 1791-1796	22
4.	Improving the comprehension of disabled readers	Williams, J.P.	1998	<i>Annals of Dyslexia</i> 48, pp. 213-232	22
5.	Brain-(not) based education: Dangers of misunderstanding and misapplication of neuroscience research	Alferink, L.A., Farmer-Dougan, V.	2010	<i>Exceptionality</i> 18(1), pp. 42-52	20
6.	Inclusive Schooling - Middle School Teachers' Perceptions	Heiman, T.	2001	<i>School Psychology International</i> 22(4), pp. 451-462	17
7.	Creating and sustaining a special education/general education partnership: A story of change and uncertainty	Trent, S.C., Driver, B.L., Wood, M.H., (...), Martin, T.F., Smith, W.G.	2003	<i>Teaching and Teacher Education</i> 19(2), pp. 203-219	16
8.	Private school diversity in Denmark's national voucher system	Rangvid, B.S.	2008	<i>Scandinavian Journal of Educational Research</i> 52(4), pp. 331-354	15
9.	The efficacy of reciprocal teaching in fostering the reading literacy of students with intellectual disabilities	Alfassi, M., Weiss, I., Lifshitz, H.	2009	<i>European Journal of Special Needs Education</i> 24(3), pp. 291-305	11
10.	Computer graphics applications in the education process of people with learning difficulties	Vera, L., Campos, R., Herrera, G., Romero, C.	2007	<i>Computers and Graphics (Pergamon)</i> 31(4), pp. 649-658	10

Table 5 shows the most cited documents on teaching methods and special education in Scopus. The top 10 most cited documents are shown in the table. As it can be seen, the most frequently-cited articles generally focused on mental retardation, inclusion, for autism spectrum disorder and learning difficulties. The article with the highest citations was published in 1993. This is probably because articles that were published earlier have a greater chance of being accessed and cited by other related studies.

## 4. DISCUSSION

This study aimed to determine the trends in the documents related with teaching methods in special education published between the years of 1975–2017. Providing a sys-

tematic review of studies in a certain database constitutes a framework for that specific field in terms of the trends (Baglama, 2017). The analysed documents were found by searching the Scopus which is one of the most prestigious databases used by many scholars and researchers worldwide (Harzing and Alakangas, 2016). A total number of 63 published documents were analysed in the study based on the content analysis criteria. According to the results, it was determined that there is a regular increase in the number of publications related with teaching methods used in special education. In contrast; Demirok, Baglama and Besgul (2015) analysed the articles published between 2009. and 2014.; and they did not found a regular increase in the number of research on special education. This might be because they did not specify the area and made a broader analysis on special education. However, spe-

cial education and teaching methods were specifically examined in the present study.

Furthermore, results showed that European Journal of Special Needs Education was the first journal with the highest number of publications related with teaching methods and special education. In addition, Bar-Ilan University and Beit Berl Academic College are the top two academic institutions mentioned as affiliations in the articles. Results also indicated that most articles have been published by the authors from the United States. This result is similar with the results of other studies showing an increase in special education research through content analysis. For example, Gedrimas (2015) found that most of the data collected for autism research were from the United States; and Demirok, M. S., Baglama, B., and Besgul, M. (2015) also found that most of the studies on special education were conducted in America.

When the results on the document types are analysed, it is seen that most of the published documents were articles. Moreover, social sciences were found as the most studied subject area with 40 published documents. This might be because of the interdisciplinary nature of special education area and social sciences might involve psychological and educational research as well. It was also determined that that 'special education' is the most used keyword in the published documents related with teaching methods and special education in Scopus database and most of the published documents were written in English. This could be associated with the fact that English as a universal language spoken, known and understood throughout the world and is the most frequently used language in the academic literature (Crystal, 2012). Finally, citation analysis of the papers revealed that the most cited documents were from Journal of Speech and Hearing Research published in 1993. with 49 citations and this is followed by European Physical Education Review in 2005. with 25 citations and Journal of Autism and Developmental Disorders in 2008. with 22 citations.

## 5. CONCLUSION AND RECOMMENDATIONS

In conclusion, this study provided an overview of studies on teaching methods and special education published in Scopus based on certain criteria. This study introduced the studies on teaching methods and special education, and therefore, it is expected that it

would provide a guidance for teachers and researchers. Following recommendations for further research and practices were presented based on the results of the present study:

- Other scientific databases might be examined in order to reveal the trends in research on teaching methods and special education.
- Further research might focus more on the teaching methods in special education especially for teachers to provide a guidance on what are the current and evidence-based teaching methods in special education.
- Different content analysis criteria such as research sample, topic, method and number of authors might be used to reveal these tendencies in the research as well.

### Conflict of interests

The authors declare no conflict of interests.

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