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## 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.

IJCRSEE particularly welcomes articles on the results of scientific research in various fields of cognitive science (psychology, artificial intelligence, linguistics, philosophy and neuroscience) catering for international and multidisciplinary audience. Readers include those in cognitive psychology, special education, education, adult education, educational psychology, school psychology, speech and language, and public policy. IJCRSEE has regular sections: Original Research, Review Articles, Studies and articles, Book Reviews, Case Studies, and is published three times a year. This journal provides an immediate open access to its contents, which makes research results available to the public based on the global exchange of knowledge. The journal also offers access to uncorrected and corrected proofs of articles before they are published.

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.

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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, DOIs and 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 Double 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.

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- Accept after revision
- Ask authors to resubmit
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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 11 articles (10 original researches and 1 review article). Our future plan is to increase the number of quality research papers from all fields of 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  
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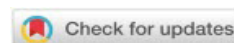
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# Applying Positive Discipline in School and Adolescents' Self-esteem

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**Abstract:** Starting from the general principles of the concept of positive discipline, the paper points out that schools and teachers can significantly contribute to the application of positive discipline to affect different aspects of a student's personality development. The potentials of applying positive discipline in the school for developing adolescents' self-esteem are particularly emphasized. Accordingly, this paper will present the results of a study that aimed to establish a correlation between assessing the presence of positive discipline in a school context and the level of adolescents' self-esteem. The survey included a convenience sample of 195 high school students from three high schools - art, technical, and grammar school. The Rosenberg Self-Esteem Scale and the scale for assessing the presence of positive discipline in the school were used to collect the data. The results showed that adolescents exhibit a high level of self-esteem, while their assessment of the presence of positive discipline in school is moderate. Also, it was found that with the increase in the assessment of the presence of positive discipline in school, the level of adolescents' self-esteem increased, and the statistically significant moderating role of the measured variables was found only in the type of high school. The conclusion points to the need to sensitize teachers to manage the classroom according to the principles of positive discipline, as well as the importance of creating the conditions that, through the phenomenon of positive discipline, effectively raise the quality of schoolwork as a whole.

*Keywords:* adolescence; positive discipline; self-esteem; school; teachers; students' social competencies.

## Introduction

Positive discipline, as an approach to upbringing, is based on the theoretical basis of individual psychology, which considers encouragement as a way of developing self-esteem and reinforcing the belief that the individuals are good enough just the way they are (Adler, 2009). The essential premise of this approach is based on the belief that, in a relationship with children, nothing can be achieved through punishment, threats, and preaching. Instead of this, the child and the adult need to be made aware of what doesn't work in their relationship and how to repair it (Adler, 2009; Nelsen, 1979). Based on this belief, as well as on the integration of knowledge about children's development, children's rights, and effective educational practices, positive discipline becomes a contemporary approach to the upbringing that is based on understanding and respecting the personality of the children, individualized approach and up-bringing by personal example (Durrant, 2013). This creates the basis for the development of personal dignity and self-esteem, respect for other people and respect for their rights, the development of empathy, and the application of non-violent communication (Bej, 2016; Durrant, 2013).

Pointing to the effectiveness of positive discipline in the family and school environment, experts (Bej, 2016; Durrant, 2013; Nelsen, 2007) emphasize that positive discipline offers a system of techniques that help children/youth develop different social skills sustainable in the long-term, self-discipline, and self-confidence when facing real-life situations. It is emphasized that this approach in upbringing and education should be applied in interaction with all children/students, and not only with children/students who are characterized by challenging behavior. Therefore, the paper starts from the view that, besides the family as a basic upbringing factor, the school also represents a very important upbringing environment and that teacher as significant another person can significantly contribute to the application of positive discipline to affect different domains of student personality development, especially during adolescence.

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### **Applying positive discipline in school - the role of teachers**

Considering the assumptions for the application of positive discipline in school practice, experts (Bej, 2016; Charles and Senter, 2005) emphasize the importance of creating a climate of respect and cooperation that contributes to students perceiving themselves as important and able to control their lives, developing self-control, flexibility and, responsibility. Also, the general school/classroom climate contributes to the development of a sense of belonging to the school, which increases academic success and reduces the risky behaviors of students (Bej, 2016; Uslu and Gizir, 2017).

One of the key assumptions is the role of the teacher, i.e., their competencies and skills for effective application of the principles of positive discipline. Special emphasis is placed on the ability of teachers to control their behavior and reflect on their actions when it comes to upbringing and educational processes (Durrant, 2010; Nelsen, 2007). The essence is that teachers express concern for students, and instead of misrepresenting the logical consequences of behavior through punishment, involve students in solving problems by providing opportunities to see the consequences of their behavior and perceive possible solutions (Burden, 2016).

This mindset and approach to the role of teacher educating are built on four principles: 1) focusing on identifying long-term goals; 2) providing warmth and structure; 3) understanding how children/students think and feel; 4) problem solving and responding with positive discipline (Durrant, 2013). Before applying these principles, teachers must understand them properly and practice their application skills. It is also important that when interacting with the student, they think about long-term goals, ways in which the student can be provided with warmth and structure, and understand why the student behaves in a certain way. The gradual application of these principles can change the way teachers think and act. On the other hand, these principles contribute to the students' acquisition of significant life and social skills (decision-making, constructive problem, and conflict resolution, etc.) that will help them become successful members of their community (Chadsey and McVittie, 2006; Durrant, 2013; Nelsen, 2006).

The importance of applying positive discipline for student development is particularly meaningful in adolescence when the influence of the relationships that individuals make outside the family is amplified (Luciana, 2010). In addition to family and peer group, the school is certainly an environment that has a great influence on the development of the individual during adolescence (Oberle, Schonert-Reichl and Zumbo, 2011), with one of the key factors in this development being the relation established in relation teacher-student/adolescent (Demirdag, 2015). In this regard, UNESCO (2006), following the specificity of adolescence, provides some recommendations for teachers to apply positive discipline:

- In the period of early adolescence, the teacher needs to be a role model for mutual respect, which implies the absence of preaching and criticism. Also, it is very important to prevent potential insults and teasing among the students themselves, so it is recommended that students get the opportunity to express their feelings and experiences in different ways.
- In middle adolescence, the recommendations are to encourage students to think creatively and critically. Praise and emphasis on positive behavior are desirable, but also setting reasonable boundaries and clear rules, and consistency in insisting on respecting the. Teachers are also encouraged to share their own beliefs, concerns, and values with students, and to encourage them to turn to adults they respect and trust in situations where they need advice.
- In late adolescence, the recommendations are to encourage discussion on various topics and respect for the uniqueness of each adolescent, because in this way young people learn to respect other people around them, to make decisions independently, and to take responsibility for the consequences of their decisions.

These recommendations on building positive and trust-based relationships between teachers and students open up space for learning and constructive problem solving (Charles and Senter, 2005), create a sense of safety and belonging (Uslu and Gizir, 2017), and help students/adolescents to accept responsibility and take positive control of their behavior in a long-term (Bej, 2016). Such effects are certainly an important potential for the development of adolescents' self-esteem, because, in this period, individuals compare their real and ideal selves, and assess their compliance with social standards and expectations.

### **Potentials of positive discipline in the school for the development of adolescents' self-esteem**

The development of self-esteem is a long-term process, which is influenced by many factors, and which goes through periods of decline when moving from one stage of development to another. This process continues even more intensely during adolescence (Papalia and Olds, 1995), especially given that during this period self-esteem levels vary with a tendency to stabilize (Abdel-Khalek, 2016).

Considering that self-esteem involves beliefs about one's competence, value, and importance, as well as emotional states regarding these (Hewitt, 2009), a high level of self-esteem helps adolescents to meet the challenges that this turbulent period brings. Therefore, it is very important to keep in mind the potential of different educational practices that can contribute to building high self-esteem in adolescents.

In this context, it can be assumed that positive discipline contributes to the building of a positive self-image in adolescents, because, among other things, it implies an individualized approach and reliance on the positive in the individual's personality. However, there is insufficient research to confirm this hypothesis, in other words, there are no results of research that could surely confirm the effects of positive discipline on the development of self-esteem. One of the key reasons for insufficient empirical confirmation of the abovementioned hypothesis can be considered, first of all, through the limitations that the attempt to measure a person's self-esteem generally carries with it. Experts (Baumeister et al., 2003) state that the main difficulty is that self-esteem is almost exclusively measured by respondents' self-reporting and the fact that there are no objective criteria by which the level of self-esteem that respondents report can be compared. The level of self-esteem examined shows how a person views and evaluates himself/herself, which does not have to coincide with the real level of self-esteem. However, despite these limitations, research into this topic is very valuable, especially when it comes to findings that indicate the potential risks of reduced self-esteem. Thus, for example, research has shown that low self-esteem, especially during adolescence, can have numerous negative consequences: the appearance of depression (Harter, 1986; Rosenberg, 1965), suicide (Kazdin et al., 1983), delinquency (Wells and Rankin, 1983), psychoactive substance use (Stacy, Newcomb and Bentler, 1992); low academic achievement (Hawkins, Catalano and Miller, 1992; Johnston and O'Malley, 1986). Bearing in mind such findings, it is necessary to prevent their occurrence, and the potential benefits of the application of positive discipline during adolescence should not be neglected.

Although examining the effects of applying positive discipline in school is not a widely represented area in empirical research, some research has shown that positive changes in students' behavior (especially when it comes to developing self-esteem during adolescence) can be associated with accepting and applying certain starting points of a positive discipline in a school context. Namely, numerous studies (Furlong et al., 2003; Haynes, Emmons and Ben-Avie, 1997; Osterman 2000; Whitlock 2006) have shown that creating positive attitudes and a sense of community in school (as a key starting point for applying positive discipline) serve as protective factors that are positively correlated with adolescent self-esteem, academic achievement, and school adjustment. Also, research (Deci et al., 1981; Demirdag, 2015; Uslu and Gizir, 2017) confirms the importance of the role of teachers in building students' self-esteem, nurturing their independence, and improving their sense of effectiveness in all periods, especially in adolescence. Specifically, it was found that students whose teachers show a greater orientation towards supporting autonomy and individuality (instead of control) also show a higher level of self-esteem. The potential significance of the starting point of positive discipline on the importance of relying on students' capacities, competencies, and talents is supported by research results (Kususanto, Ismail and Jamil, 2010) that the teacher's beliefs about students can be manifested through their behavior that students can detect and which can afterward lead to either increasing or decreasing students' motivation and perception of personal competence.

The above findings indicate the importance of research into this topic because, in addition to contributing to the understanding of the potential of applying positive discipline for the development of student/adolescent self-esteem, they also point to the importance of creating a school ethos that will be sensitized to this approach in upbringing. Within this framework, a draft of the research was designed, the results of which will be presented in the text below.

## Materials and Methods

Goals and objectives of the research. The overall goal of the research was to determine the correlation between the assessment of the presence of positive discipline in the school context and the level of adolescents' self-esteem. Based on the set goal, the following research objectives were formulated: 1. To examine the adolescents' assessment of the presence of positive discipline in the school, and whether there are differences in assessment depending on the gender of the adolescents and the type of school; 2. To examine the level of adolescents' self-esteem, and whether there are differences in the level depending on the gender and academic achievement of adolescents; 3. Examine the nature of the correlation between the assessment of the presence of positive discipline in school and the level of adolescents' self-esteem, and to what extent the assessment of the presence of positive discipline in

school explains the level of adolescents' self-esteem; 4. Examine the moderating role of gender, high school type, and academic achievement in the relationship between assessing the presence of positive discipline in school and the level of adolescents' self-esteem.

Measurements and variables. Two instruments were used to achieve the set research goal:

- Rosenberg's Self-Esteem Scale (RSES) (Rosenberg, 1965), despite general limitations in measuring self-esteem, showed high levels of validity and reliability (according to Robins, Hendin and Trzesniewski, 2001), which was also confirmed at the sample level in our study (Kronbach's alpha is .867). The scale has ten items, using a five-point Likert-type scale (from 1- I disagree to 5 - strongly agree), which in some earlier studies (Leung, 2011) found very similar basic psychometric characteristics as the original four-point scale.

- The scale for assessing the presence of positive discipline in the school was constructed for this research, based on the study of the theoretical basis and characteristics of positive discipline outlined by Jane Nelsen (Nelsen, 2007). The scale consisted of ten items that are related to key principles of the application of positive discipline by teachers: 1) the principle of focusing on long-term goals in upbringing: (Teachers help me to understand the consequences of my behavior and to develop responsibility for them; Teachers strive to help me to learn something meaningful for everyday life in each unit; Teachers remain consistent and stick to everything they promise); 2) the principle of providing warmth and structure (Teachers are interested in my feelings, not just knowledge and school life; teachers are not interested to understand explanations and reasons for my actions); 3) the principle of individualized approach and reliance on the positive in personality (Teachers praise the effort I put in; Teachers explain each grade they give me; Teachers strive to value my knowledge, interest, and commitment that I show); 4) the principle of problem-solving and responding with positive discipline (Teachers strive to understand the situation I am in or the mistake I make; Teachers are not ready to find a compromise and help to jointly resolve the situation or problem I find myself in). The answers were expressed in the form of a five-point Likert-type scale (1-never, 2-rarely, 3-sometimes, 4-almost always, 5-always), and the analysis determined that it was a one-factor scale showing satisfactory metric characteristics (Kronbach's alpha amounts to .788).

The following variables were used: independent variable (adolescents' assessment of the presence of positive discipline at school); dependent variable (adolescents' self-esteem); extraneous variables (sex, school achievement, high school type). In analyzing the data collected, and to accomplish the set objectives, for certain variables (sex, school achievement, and high school type) their moderating role is analyzed in the relationship between independent and dependent variables.

Sample and statistical procedures. The study involved 195 high school grade students from three high schools in Novi Sad, in the Republic of Serbia. Sample included 97 (49.7%) male and 98 (50.3%) female respondents. The number of students from Art high school we included in this study was 64 (32.8%), 78 students from grammar school (27.2%), and 53 students from Technical high school (40%). When it comes to school achievement the sample consisted of 108 students with excellent (55.4%), 66 with very good (33.8%), 18 with good (9.2%), and 3 (1.5%) students with sufficient school achievement. In the study conducted there were no students with poor academic achievement.

For the statistical analysis of the data, it was used SPSS package and within it the descriptive statistics procedures (determination of the normality of distribution of the collected data, determination of the reliability of the instruments, t-test of independent samples, ANOVA, correlation, regression, and moderation PROCESS analysis).

## Results

The research results will be presented according to the research objectives under the set research framework. The first research objective was to determine the presence of positive discipline in school, as assessed by adolescents. At the level of the entire scale for assessing the presence of positive discipline, the arithmetic mean is 29.94 (min = 12, max = 44). Given that the scale used is not standardized, it is not possible to conclude on the level of assessment of the presence of positive discipline. Nevertheless, based on the arithmetic value of the scale that is in the second half of the distribution, it can be concluded that adolescents evaluate the use of positive discipline as moderately present. The resulting descriptive statistics values for each item are shown in Table 1.

**Table 1**  
*The scale of assessment of the presence of positive discipline in schools*

	Item	Min	Mean	Max
1.	Teachers are interested in my feelings, not just knowledge and school life.	1	1.99	5
2.	Teachers make an effort to understand the situation I am in or the mistake I make.	1	2.44	5
3.	Teachers are not interested in the explanation and reasons for my actions.	1	3.03	5
4.	Teachers are not ready to find a compromise and jointly resolve a situation or problem that I find myself in.	1	3.23	5
5.	Teachers explain each grade I get.	1	3.30	5
6.	Teachers remain consistent and stick to everything they promise.	1	3.25	5
7.	Teachers strive to value my knowledge, interest, and commitment that I show.	1	3.50	5
8.	Teachers praise the effort I put in.	1	3.22	5
9.	Teachers help me understand the consequences of my behavior and develop responsibility for them.	1	2.91	5
10.	Teachers do their best to help me learn something meaningful for everyday life in each unit.	1	3.02	5

In order to examine differences in adolescent's assessment of the presence of positive discipline concerning the type of high school, one-factor analysis of variance was conducted (Table 2). The results showed that there were no statistically significant differences in the assessment of the presence of positive discipline, depending on the type of high school students attend.

**Table 2**  
*Applying positive discipline and the type of high school*

	N	Mean	SD	F	p
Art school	64	28.92	6.03		
Technical school	53	29.73	7.21	1.25	.84
Grammar school	78	30.92	5.56		
Total	195	29.94	6.23		

To examine differences in the assessment of the presence of positive discipline in school concerning the sex of adolescents, a t-test of independent samples was conducted. The results obtained (Table 3) show that female adolescents are more likely to perceive the presence of positive discipline in school than male adolescents, but the difference in assessment is not statistically significant.

**Table 3**  
*Applying positive discipline and the sex of adolescents*

	Sex	N	Mean	SD	t	p
Applying positive discipline in school	Male	97	29.06	6.27	-1.86	.06
	Female	98	30.71	6.11		

The second research objective was to determine adolescents' self-esteem levels. An arithmetic means of 38.07 (min = 14, max = 50) indicates that the adolescents surveyed exhibit a high level of self-esteem. By examining differences in adolescents' self-esteem levels concerning adolescent sex, no statistically significant differences were found (Table 4).

**Table 4**  
*Self-esteem and the sex of adolescents*

	Sex	N	Mean	SD	t	p
Self-esteem	Male	97	38.31	8.06	.43	.66
	Female	98	37.82	7.79		

By examining differences in adolescents' self-esteem levels concerning school achievement, one-factor analysis of variance revealed statistically significant differences (Table 5). The arithmetic means values indicate that adolescents with better school achievement also exhibit higher levels of self-esteem.

**Table 5**  
*Self-esteem and adolescents' school achievement*

	N	AS	SD	F	p
Sufficient	3	28.66	5.50	3.32	.02
Good	18	35.88	9.30		
Very good	66	37.00	8.34		
Excellent	108	39.35	7.16		
Total	195	38.07	7.91		

The third research objective was to examine the correlation between assessing the presence of positive discipline in school and adolescent's self-esteem. To this end, the Pearson linear correlation coefficient was applied, and the values obtained are shown in Table 6.

**Table 6**  
*Correlation between applying positive discipline in schools and the adolescents' self-esteem*

	Applying positive discipline in schools	Adolescents' self-esteem	p
Applying positive discipline in schools	1	.32	.00
Adolescents' self-esteem	.32	1	

The statistical analysis conducted confirmed the existence of a statistically significant and positive correlation between the assessment of the presence of positive discipline in school and the level of adolescents' self-esteem. The results show that with the increase in the assessment of the presence of positive discipline at school, the level of adolescents' self-esteem also increases.

To see the extent to which the assessment of the presence of positive discipline at school explains the level of adolescents' self-esteem, a regression was performed (Table 7). The assessment of the presence of positive discipline in school was found to explain 9.8% of the adolescent self-esteem variable.

**Table 7**  
*Regression – the extent to which the assessment of the presence of positive discipline at school explains the level of adolescents' self-esteem*

	R	R <sup>2</sup>	Kor. R <sup>2</sup>	p
Applying of positive discipline in schools	.312	.098	.093	.00

The fourth research objective was to determine the moderating role of sex, school achievement, and type of high school. Therefore, process analysis of the interaction of these variables, and their impact on the relationship between the assessment of the presence of positive discipline in school and the level of adolescents' self-esteem was made. A model that included a variable for assessing the presence of positive discipline in school and adolescents' sex turned out to be statistically significant ( $F(3, 191) = 7.33$ ;  $p < 0.01$ ;  $R^2 = .10$ ). Regarding the moderator role of sex, no statistical significance was found ( $b = 5.36$ ;  $t(191) = -.46$ ;  $p = .64$ ). A model that included a variable for assessing the presence of positive discipline in school and adolescents' school achievement turned out to be statistically significant ( $F(3, 191) = 9.19$ ;

$p < 0.01$ ;  $R^2 = .12$ ) but no statistical significance was found in examining the moderating role of school achievement ( $b = 6.15$ ;  $t(191) = 1.91$ ;  $p = 0.056$ ). A model that included the positive discipline presence assessment variable and high school type proved to be statistically significant ( $F(3, 191) = 10.16$ ;  $p < 0.01$ ;  $R^2 = .13$ ). In examining the moderator role of the high school type, statistical significance was found ( $b = 8.17$ ;  $t(191) = 2.48$ ;  $p = 0.01$ ). Table 8 shows the results of the moderator role concerning the type of high school.

**Table 8**  
*Moderator role of the type of high school*

	b	se	t	p	LLCI	ULCI
Art school	.60	.13	4.32	.00	.3275	.8770
Technical school	.37	.08	4.32	.00	.2031	.5432
Grammar school	.14	.13	1.05	.29	-.1260	.4140

An insight into Table 8 shows that a statistically significant moderating role of the assessment of the application of positive discipline exists in art and technical school. It can also be observed that with the increase of one unit of assessment of the presence of positive discipline in art school, adolescents' self-esteem increases by .60, and that with the increase of one unit of assessment of the presence of positive discipline in technical school adolescents' self-esteem increases by .37. Grammar school students showed that a higher assessment of the presence of positive discipline was not statistically significant for the change in adolescents' self-esteem.

## Discussion

Based on the results of the adolescent assessment of the presence of positive discipline in school, it is possible to see that items related to the application of the principles of positive discipline (such as consistency and focus on problem-solving, reliance on positive and long-term goals) are assessed at a high level. On the other hand, adolescents believe that respect for desires and feelings, i.e., providing warmth and structure as an important principle of applying positive discipline in the school context, is the least present. Although in the relevant literature (Nelsen, 2007) the individualized approach is emphasized as a key aspect of positive discipline, the findings obtained at the level of our sample show that it is the least present. The importance of applying an individualized approach, especially when working with adolescents, is emphasized by the results of other research (Ames and Miller, 1994; Deci et al., 1982; Demirdag, 2015) which indicate that teachers who know each of their students, respect their needs, support their autonomy, value and respect their personality as a whole, and positively influence the intrinsic motivation and self-esteem of students. Also, research (Deci et al., 1982; Demirdag, 2015) has shown that controlling behavior in relationships with students, i.e., the authoritarian approach as a classroom management strategy, has a limited positive impact on adolescent personality. In line with the above, the findings obtained at the level of our sample may indicate a tendency for teachers to practice a more directive style of communication, which contradicts the basic postulates of positive discipline and individualized approach, which include non-directive communication style, and the use of praise, encouragement, and acceptance of students' ideas.

When it comes to the type of school, the results showed that adolescents surveyed in all three high schools evaluate the application of positive discipline at a similar level. This result may indicate that, regardless of the type of high school, teachers prefer a certain style of behavior and form of communication that may be in a certain relationship with a more or less assessed level of application of positive discipline. Therefore, a proposal for further research would be to analyze the relationship that exists between teacher behavior styles and the level of application of positive discipline. Also, the obtained findings indicate an equally important need to improve the pedagogical competencies of teachers in both grammar school and secondary vocational schools.

When it comes to the results related to the self-esteem variable, it was shown that the examined adolescents express a high level of self-esteem. This finding can be related to the tendency of self-esteem to stabilize in this period, which Rosenberg confirmed in his research (according to Tashakkori et al., 1990). The relevant literature (Dumont and Provost, 1999; Tashakkori et al., 1990) points out that the presence of high levels of adolescent self-esteem can be associated with a more positive interpretation of everyday circumstances, changes, and stress that adolescents face in this unstable period of development

but also with experiencing more positive situations and experiences in everyday life. Interestingly, some researchers (Thorne and Michaelieu, 1996) found a difference in the level of self-esteem of adolescents in favor of male adolescents, which they explained by the premise that self-esteem in adolescence is based primarily on perceptions of the individual about his/her body and appearance, which have in mind the social pressures and the image of the woman that exists in modern society, as well as the faster physical maturation of adolescents, can cause lower levels of self-esteem in female adolescents. Similarly, other researchers (Robins et al., 2002; Zeigler-Hill and Myers, 2012) have pointed to differences in self-esteem in favor of male adolescents, and that this difference remains noticeable during early and middle adolescence, after which decreases and disappears at a later age. The results of our study showed results in self-esteem in favor of male adolescents, but not at a statistically significant level, which may be due to a small sample of respondents.

The analysis related to determining the differences in the level of self-esteem of adolescents concerning school achievement showed that adolescents with better school achievement also express a higher level of self-esteem. However, this result should be taken with a reservation, having in mind the uneven distribution of the sample according to school success, but also the difficulties in clearly understanding the cause-and-effect relations of these two variables. Namely, numerous studies (Baumeister et al., 2003) have confirmed a positive correlation between school achievement and self-esteem, but at different levels of strength. Some authors (Hansford and Hattie, 1982) found that there was a statistically significant and positive correlation between school achievement and self-esteem, and regression found that self-esteem explains between 4% and 7% of the school achievement variable. Also, research (Baumeister et al., 2003; Manning, 2007) has found that better school achievement leads to higher levels of self-esteem, ie that high self-esteem is the result, not the cause of good school achievement. All the above points to a positive correlation between these two variables, but also to their complex and ambivalent relationship, which makes it more difficult to interpret the research results more precisely.

When it comes to examining the relationship between the predictor and criterion variable, it was found that with the increase of assessment of the presence of positive discipline, the adolescent's self-esteem potentially grows. This is supported by the results of previous research (Demirdag, 2015) which showed that if teachers set high expectations, rely on the positive in adolescence, are focused on long-term goals, and are consistent in their actions, can positively affect adolescents' self-esteem. The claims related to these aspects of the application of positive discipline in school were the ones that were assessed as the most present by the surveyed adolescents.

By applying process analysis, a statistically significant moderator role of the high school type was found. An interesting finding is that in secondary vocational schools it has been shown that adolescents' self-esteem grows if the assessment of the presence of positive discipline also grows. On the other hand, the respondents from grammar high school showed stability of self-esteem, regardless of the assessment of the presence of positive discipline. This situation may be a consequence of the already built experience of academic self-efficacy in grammar high school students, which is also reflected in their experience of self-worth (Gutvajn and Džinović, 2019). In any case, the obtained findings imply the need for further research on the relationship between the specifics of the school environment (dimensions of school climate, educational style of teachers) and personal characteristics of students (personality traits, academic self-concept, goal orientation, etc.) that may be important for their self-esteem development.

### **Limitations and recommendations for further research**

Although the findings provide a good starting point for considering the possibility of improving positive discipline in schools in Serbia, it is important to mention the limitations of the research as well as recommendations for further research on this topic. The key limitation refers to the sample of respondents because it is a convenient sample that prevents the generalization of the results of the research to a wider population of students. Another limitation regarding the sample of respondents is the inhomogeneous distribution of respondents concerning school achievement, and because of that the results of the analysis according to this variable must be taken with a reservation. Also, it is necessary to keep in mind that in this research, only the perspective of adolescents is presented, which can make it difficult to draw conclusions about the real representation of positive discipline in schools. Accordingly, future research on this topic should include teachers' perspectives on the importance and effects of applying positive discipline, as well as their self-assessment of dominant educational procedures and classroom management strategies. In addition to all the above, in further research on this topic, it would be desirable to apply some other research methods (such as systematic observation, interviewing, focus group examination) that would provide a more accurate image of the researched subject.

## Conclusion

Generally speaking, the results of the presented research point to the conclusion that the application of positive discipline in the school environment can be viewed as a significant potential for strengthening the self-esteem of students/adolescents. On the other hand, we should not ignore the finding that, according to the respondents, teachers insufficiently apply the principles of the individualized approach, providing warmth and structure, as well as relying on the positive in the personality of students. In this sense, the key practical implication of the findings relates to the need for teachers to master strategies for effective classroom management (Demirdag, 2015; Uslu and Gizir, 2017), because such teacher competencies are important for the effective application of positive discipline, and therefore for the development of adolescent self-esteem.

It is also important to emphasize that the potential benefits of applying positive discipline for the development of students' / adolescents' self-esteem should be viewed as an important resource for preventing various forms of undesirable behavior and thus for creating school as a safe environment (McVittie, 2003; Osher et al., 2010). Particular emphasis is placed on the positive effects of combining two approaches to improving school discipline - Support for Positive School Behavior (SBPBC) which aims to develop a student behavior management system and Social-Emotional Learning (SEL) which aims to develop resources for student self-discipline (according to Osher et al., 2010). Although these approaches differ in their primary goals, what they have in common is that they are aimed at preventing problematic behavior and promoting students' social competencies.

Given that self-esteem is a significant protective factor in preventing antisocial behaviors (Dobrescu, 2013), the school's task is to allow each student to develop their potential and grow up in a climate of appreciation and respect (Bej, 2016; Gutvajn and Džinović, 2019). Therefore, it would be desirable to focus on the development of professional competencies, not only teachers but also all actors in school life, in order to create conditions to effectively raise the quality of schoolwork as a whole through the phenomenon of positive discipline. Finally, the importance of family/parent involvement should not be left out (McVittie, 2003; Uslu and Gizir, 2017), as well as the importance of harmonizing parenting style and teaching style (Paulson, Marchant, and Rothlisberg, 1998), having in mind that an authoritative style is recommended as a starting point for effectively applying positive discipline in both family and school (Nelsen, 2006). In that sense, it is very important to nurture such a cooperative relationship between families and schools that will contribute to the application of the principles of positive discipline in both developmental environments to maintain continuity in educational procedures towards children/students.

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### Conflict of interests

The authors declare no conflict of interest.

## References

- Abdel-Khalek, A. (2016). Introduction to the Psychology of self-esteem. In F. Holloway (Ed.), *Self-esteem: perspectives, influences, and improvement strategies* (pp. 1-23). New York: Nova Science Publishers.
- Adler, A. (2009). *Understanding life: An introduction to the Psychology of Alfred Adler*. UK: Oneworld.
- Ames, N. L., & Miller, E. (1994). *Changing middle schools, how to make schools work for young adolescents*. California: Jossey-Bass Publishers.
- Baumeister, R. F., Campbell, J. D., Krueger, J. I., & Vohs, K. D. (2003). Does High Self-Esteem Cause Better Performance, Interpersonal Success, Happiness, or Healthier Lifestyles. *Psychological Science in the Public Interest* 4(1), 1-44. <https://doi.org/10.1111%2F1529-1006.01431>
- Bej, M. (2016). Social Skills and Programs of Positive Discipline in School Environment – A Literature Review. *Mediterranean Journal of Social Sciences*, 7(2 S1), 84-87. <http://dx.doi.org/10.5901/mjss.2016.v7n2s1p84>
- Burden, P. (2016). *Classroom Management: Creating a Successful K-12 Learning Community*. New York: John Wiley & Sons.
- Chadsey, T., & McVittie, J. (2006). *The Positive Discipline School*. Positive Discipline Association. Retrieved from: <https://positivediscipline.org/resources/Documents/PDSbrchr-8-06.pdf>
- Charles, C. M., & Senter, G. W. (2005). *Building classroom discipline*. Boston: Pearson.
- Deci, E. L., Schwartz, A. J., Sheinman, L., & Ryan, R. M. (1981). An Instrument to assess adults' orientations toward control

- versus autonomy with children: Reflexion on intrinsic motivation and perceived competence. *Journal of Educational Psychology*, 73(5), 642-650. <https://doi.org/10.1037/0022-0663.73.5.642>
- Deci, E. L., Spiegel, N. H., Ryan, R. M., Koestner, R., & Kauffman, M. (1982). Effects of performance standards on teaching styles: Behavior of controlling teachers. *Journal of Educational Psychology*, 74(6), 852-859. <https://doi.org/10.1037/0022-0663.74.6.852>
- Demirdag, S. (2015). Classroom management and students' self-esteem: Creating positive classrooms. *Educational Research and Reviews*, 10(2), 191-197. <https://doi.org/10.5897/ERR2014.2000>
- Dobrescu, A. (2013). Adolescent self-esteem. *Bulletin of the Transilvania University of Braşov, Series VII: Social Sciences and Law*, (2), 139-144.
- Dumont, M., & Provost, M. A. (1999). Resilience in adolescents: Protective role of social support, coping strategies, self-esteem, and social activities on experience of stress and depression. *Journal of Youth and Adolescence*, 28(3), 343-363. <https://doi.org/10.1023/a:1021637011732>
- Durrant, J. E. (2010). *Positive discipline in everyday teaching: Guidelines for educators*. Save the Children Sweden.
- Durrant, J. E. (2013). *Positive discipline in everyday parenting*. Ottawa, ON: Save the Children Sweden.
- Furlong, M. J., Whipple, A. D., Jean, G. S., Simental, J., Soliz, A., & Punthuna, S. (2003). Multiple contexts of school engagement: Moving toward a unifying framework for educational research and practice. *The California School Psychologist*, 8(1), 99-113. <https://doi.org/10.1007/bf03340899>
- Gutvajin, N., & Džinović, V. (2019). *Identitet neuspešnog učenika*. [The identity of an unsuccessful student]. Belgrade: Institute for Pedagogical Research.
- Hansford, B. C., & Hattie, J. A. (1982). The relationship between self and achievement/performance measures. *Review of Educational Research*, 52(1), 123-142. <https://doi.org/10.3102/00346543052001123>
- Harter, S. (1986). Cognitive-developmental processes in the integration of concepts about emotions and the self. *Social cognition*, 4(2), 119-151. <https://doi.org/10.1521/soco.1986.4.2.119>
- Hawkins, J. D., Catalano, R. F., & Miller, J. Y. (1992). Risk and protective factors for alcohol and other drug problems in adolescence and early adulthood: Implications for substance abuse prevention. *Psychology Bulletin*, 112(1), 64-105. <https://doi.org/10.1037/0033-2909.112.1.64>
- Haynes, N. M., Emmons, C., & Ben-Avie, M. (1997). School climate as a factor in student adjustment and achievement. *Journal of Educational and Psychological Consultation*, 8(3), 321-329. [https://doi.org/10.1207/s1532768xjepc0803\\_4](https://doi.org/10.1207/s1532768xjepc0803_4)
- Hewitt, J. P. (2009). *Oxford Handbook of Positive Psychology*. Oxford: Oxford University Press.
- Johnston, L. D., & O'Malley, P. M. (1986). Why do the nation's students use drugs and alcohol: Self-reported reasons from nine national surveys. *Journal of Drug Issues* 16(1), 29-66. <https://doi.org/10.1177/002204268601600103>
- Kazdin, A. E., French, N. H., Unis, A. S., Esveldt-Dawson, K., & Sherick, R. B. (1983). Hopelessness, depression, and suicidal intent among psychiatrically disturbed inpatient children. *Journal of consulting and clinical psychology*, 51(4), 504-510. <https://doi.org/10.1037/0022-006x.51.4.504>
- Kususanto, P., Ismail, H. N., & Jamil, H. (2010). Students' self-esteem and their perception of teacher behavior: A study of between-class ability grouping. *Electronic Journal of Research in Educational Psychology*, 8(2), 707-724. <https://doi.org/10.25115/ejrep.v8i21.1395>
- Leung, S. O. (2011). A comparison of psychometric properties and normality in 4-, 5-, 6-, and 11-point Likert scales. *Journal of Social Service Research*, 37(4), 412-421. <https://doi.org/10.1080/01488376.2011.580697>
- Luciana, M. (2010). Adolescent brain development: Current themes and future directions. Introduction to the special issue. *Brain and Cognition*, 72(1), 1-5. <https://doi.org/10.1016/j.bandc.2009.11.002>
- Manning, M. A. (2007). Self-concept and self-esteem in adolescents. *Student services*, 2, 11-15. Retrieved from: <https://www.semanticscholar.org/paper/Self-Concept-and-Self-Esteem-in-Adolescents-Manning/5367523293360cf1fd39a4da7a7f4e7e27bfcbaa>
- McVittie, J. (2003). *Research Supporting Positive Discipline in Homes, Schools, and Communities*. Positive Discipline Association. Retrieved from: <https://positivediscipline.org/resources/Documents/ResearchSupportingPositiveDisciplineinHomesSchoolsandCommunities.pdf>
- Nelsen, J. (1979). *The effectiveness of Adlerian parent and teacher study groups in changing child maladaptive behavior in a positive direction*. University of San Francisco, San Francisco, California. Retrieved from: <https://positivediscipline.org/resources/Documents/TheEffectivenessOfAdlerianParentandTeacherStudyGroups.pdf>
- Nelsen, J. (2006). *Positive Discipline: The Classic Guide to Helping Children Develop Self-Discipline, Responsibility, Cooperation, and Problem-Solving Skills*. New York: Ballantine Books.
- Nelsen, J. (2007). *Cómo educar con firmeza y cariño: disciplina positiva*. [How to educate with firmness and kindness: Positive discipline]. Barcelona: Médici.
- Oberle, E., Schonert-Reichl, K. A., & Zumbo, B. D. (2011). Life satisfaction in early adolescence: Personal, neighborhood, school, family, and peer influences. *Journal of youth and adolescence*, 40(7), 889-901. <https://doi.org/10.1007/s10964-010-9599-1>
- Osher, D., Bear, G. G., Sprague, J. R., & Doyle, W. (2010). How can we improve school discipline? *Educational researcher*, 39(1), 48-58. <https://doi.org/10.3102/0013189X09357618>
- Osterman, K. F. (2000). Students' need for belonging in the school community. *Review of educational research*, 70(3), 323-367. <https://doi.org/10.3102/00346543070003323>
- Papalia, E. D., & Olds, W. S. (1995). *Human development 5<sup>th</sup> edition*. New York: Mcgraw-Hill College.
- Paulson, S. E., Marchant, G. J., & Rothlisberg, B. A. (1998). Early adolescents' perceptions of patterns of parenting, teaching, and school atmosphere: Implications for achievement. *The Journal of Early Adolescence*, 18(1), 5-26.
- Robins, R. W., Trzesniewski, K. H., Tracy, J. L., Gosling, S. D., & Potter, J. (2002). Global self-esteem across the life span. *Psychology and aging*, 17(3), 423-434. <https://doi.org/10.1037/0882-7974.17.3.423>
- Robins, R. W., Hendin, H. M., & Trzesniewski, K. H. (2001). Measuring global self-esteem: Construct validation of a single-item measure and the Rosenberg Self-Esteem Scale. *Personality and social psychology bulletin*, 27(2), 151-161. <https://doi.org/10.1177/0146167201272002>
- Rosenberg, M. (1965). *Society and the adolescent self-image*. Princeton, NJ: Princeton University Press.

- Stacy, A. W., Newcomb, M. D., & Bentler, P. M. (1992). Interactive and higher-order effects of social influences on drug use. *Journal of Health and Social Behaviour*, 33(3), 226-241. <https://doi.org/10.2307/2137353>
- Tashakkori, A., Thompson, V. D., Wade, J., & Valente, E. (1990). Structure and stability of self-esteem in late teens. *Personality and individual differences*, 11(9), 885-893. [https://doi.org/10.1016/0191-8869\(90\)90268-v](https://doi.org/10.1016/0191-8869(90)90268-v)
- Thorne, A., & Michaelieu, Q. (1996). Situating adolescent gender and self-esteem with personal memories. *Child Development*, 67(4), 1374-1390. <https://doi.org/10.2307/1131706>
- Unesco (2006). *Positive discipline in the inclusive, learning-friendly classroom: a guide for teachers and teacher*. Retrieved from: <https://unesdoc.unesco.org/ark:/48223/pf0000149284>
- Uslu, F., & Gizir, S. (2017). School Belonging of Adolescents: The Role of Teacher-Student Relationships, Peer Relationships and Family Involvement. *Educational sciences: theory & practice*, 17(1), 63-82. <https://doi.org/10.12738/estp.2017.1.0104>
- Wells, E. L., & Rankin, J. H. (1983). Self-concept as a mediating factor in delinquency. *Social Psychology Quarterly* 46(1), 11-22. <https://doi.org/10.2307/3033656>
- Whitlock, J. L. (2006). Youth perceptions of life at school: Contextual correlates of school connectedness in adolescence. *Applied Developmental Science*, 10(1), 13-29. [https://doi.org/10.1207/s1532480xads1001\\_2](https://doi.org/10.1207/s1532480xads1001_2)
- Zeigler-Hill, V., & Myers, E. M. (2012). A review of gender differences in self-esteem. In S. P. McGeown (Ed.). *Psychology research progress. Psychology of gender differences* (pp. 131-143). Hauppauge, NY, US: Nova Science Publishers.



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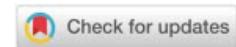
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# Does Student's Cognitive Flexibility Decrease During Pandemic? A New Approach to Measure Cognitive Flexibility

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**Abstract:** The aim of this study is to examine the cognitive flexibility before and during the COVID-19 pandemic through a different performance measurement suitable for online application. In the study, three different data collected in 2019 (T19), 2020 (T20) and 2021 (T21) were compared with both within-and between-subject designs. One-hundred-and-twenty-three university students were included in the study for within-subjects, 239 for between-subject. According to the findings of the study, the cognitive flexibility of the students who continue formal education in T19 is higher than the students who continue distance education in T20 according to both within-subject and between-subject design. Besides, in both designs, fewer total words were produced in T19 than in T20. The sentences created by the students who continue their distance education in pandemic stay around less categories and contain more words. According to the within-subject findings obtained at T20 and T21, the cognitive flexibility and total words produced at T20 were greater. In other words, the scores of the students decreased over time during the pandemic period. In T21, cognitive flexibility is not related to vulnerability, perceived risk, and fear of COVID-19. However, according to the regression results, vulnerability at T21 was predicted by the total word and total emotional word in T20. Accordingly, producing more total words in T20 reduced vulnerability in T21; however, using more emotional words in T20 increased vulnerability in T21. In addition, the number of siblings was negatively associated with vulnerability. Lastly, cognitive flexibility test was found to be reliable.

**Keywords:** cognitive flexibility, performance measurement, emotional word, COVID-19, vulnerability, fear, perceived risk.

## Introduction

Cognitive flexibility enables individuals to follow and succeed in complex tasks, and to adapt to changing demands. Besides, it is an important characteristic that depends on the interaction of sensorimotor and various cognitive mechanisms (Ionescu, 2012). Cognitive flexibility is defined as the cognitive ability to switch between two different concepts and to think about different concepts at the same time (Scott, 1962). Therefore, cognitive flexibility is an executive function that involves shifting attention to another set (e.g., Lehto et al., 2003). Also, cognitive flexibility is defined as "the ability to benefit from different categories, the number of different categories used" in performance measures (e.g., Rietzschel, De Dreu and Nijstad 2007; Murray et al., 1990). On the other hand, cognitive flexibility also reflects the revealing of unique semantic relationships (Jung-Beeman et al., 2004). Cognitive flexibility is a more complex process than a simple response shifting (Whiting et al., 2017). Neuroimaging studies have shown that when the language component is added to cognitive flexibility, more brain regions are activated in a complex manner. This is a complex process in which processing speed, working memory, and language processes have shared neural substrates with the frontal, parietal, and temporal regions of the brain (Barbey, Colom and Grafmanet, 2013).

The concept of cognitive flexibility is more evidence-based and larger than psychological flexibility (Whiting et al., 2017). Abstract definitions of psychological flexibility and cognitive flexibility are similar, but the functional goals of the concept of cognitive flexibility have reduced it to a shift setting (Ionescu, 2012). Both concepts include a behavioural change as an intellectual or movement towards environmental changes. The significant difference between the two concepts is the role of the self and acceptance in the context. Accordingly, while cognitive flexibility includes adapting to changing cues, psychological flexibility includes seeing oneself apart from experiences and emotions and being able to accept these experiences

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instead of behavioural change and experiential avoidance when necessary (Whiting et al., 2017).

While psychological flexibility enables individuals to adapt to variable conditions, it also requires changing the behavioural repertoire when necessary (Kashdan and Rottenberg, 2010). It has been shown in different contexts that psychological flexibility is an important variable in maintaining mental health, and the lack of psychological flexibility in many psychopathology situations (Bond and Flaxman, 2006; Ciarrochi, Bilich and Godsallet, 2010; Kashdan and Rottenberg, 2010; McCracken and Morley, 2014). In times of such intense COVID-19 pandemic, both psychological and cognitive flexibility emerge as important concepts (e.g., Dawson and Golijani-Moghaddam, 2020; Fernandez Lynch et al., 2020; Kroska et al., 2020; Pakenham et al., 2020). Psychological flexibility has been shown to be effective in moderating the potentially harmful effects of COVID-19 risk factors (Pakenham et al., 2020). Besides, psychological flexibility is positively associated with well-being. It has been shown to be negatively associated with anxiety, depression, and distress related to COVID-19 (Dawson and Golijani-Moghaddam, 2020). Openness to experience, behavioural awareness, and valued action, which are components of psychological flexibility, might be important targets in intervention and prevention regarding COVID-19 (Kroska et al., 2020).

Apart from this, there are fewer studies in the context of cognitive flexibility than the concept of psychological flexibility. Jafari (2020) revealed that the self-reported cognitive flexibility taken with the Cognitive Flexibility Inventory was negatively correlated with anxiety during the COVID-19 period, and that the control sub-dimension of cognitive flexibility was negatively correlated with risk perception. Afshari, Hashemikamangar and Hashemikamangar (2021) found that both the control and alternatives sub-dimensions of cognitive flexibility are negatively correlated with the risk perception of COVID-19. Cognitive flexibility was found to have a negative correlation with social-distance fatigue, and a positive correlation with compliance with social distance (Seiter and Curran, 2021). Further, cognitive flexibility of COVID-19 patients who responded to home treatment was found to be significantly higher than those who did not respond to treatment (Jafari, 2020). As a result of these findings, it is understood that cognitive flexibility is an important variable in coping with COVID-19. However, all the studies presented here took measures of cognitive flexibility via self-report. In a period where cognitive flexibility is so important, it is crucial to conduct a study in which performance measurement is taken.

The current study examines cognitive flexibility in the context of students. The distance education process has started to take place in our lives more than ever due to COVID-19, and distance education has become inevitable due to current conditions (Kim, 2020). The pandemic has caused a global crisis in higher education (Raaper and Brown, 2020). According to Aucejo et al., (2020), 13% of students post-poned their graduation due to COVID-19, 40% lost their jobs, internships or job offers, and 29% expect less earnings by the age of 35. Chen, Kaczmarek and Ohyamaet (2020) shows that according to the perception of a significant majority of students, burnout in distance education has increased and engagement in lessons has decreased. Fifteen percent of medical students are concerned that the pandemic will affect their specialty choices (Byrnes et al., 2020). Chinese students studying overseas stated that they have anxiety largely stemming from media discrimination and fear of COVID-19 (Ma and Miller, 2020). Besides these effects of the pandemic on students' academic and daily lives, there are also partially positive effects due to the transition to distance education. For example, students have faced many difficulties, their engagement has decreased, and their learning opportunities have been damaged, but there are also positive effects such as students' ability to attend classes in their location and flexibility in learning processes (Hill and Fitzgerald, 2020). Again, due to COVID-19, while 25% of students' study hours increased by more than 4 hours per week, another 25% decreased by more than 5 hours per week (Aucejo et al., 2020). It is conceivable that COVID-19 reduces students' motivation, disrupts their daily routines, and reduces coping strategies required to deal with stressors (Grubic Badovinac and Johri, 2020). Therefore, it is important to study on and develop solutions for possible effects. In this context, it becomes important to understand the role of cognitive flexibility.

To measure cognitive flexibility, many methods have been used previously, including self-report and performance measurement. Some of the methods used in the performance measures of cognitive flexibility are Alternative Uses Test (AUT; Guilford, 1967), Torrance Creativity Test (TTCT; Almedia et al., 2008) and Wisconsin Card Sorting Test (WCST; Kongs et al., 2000). Cognitive flexibility is considered as a sub-dimension in creativity tests such as AUT and TTCT. Cognitive Flexibility Inventory (CFI; Dennis, and Vander Wal, 2010) and Cognitive Flexibility Scale (CFS; Bilgin, 2009) are among the most used scales in self-report measurement of cognitive flexibility. Studies investigating the relations of cognitive flexibility between self-report and performance measurement show that the correlation between self-report and performance measures is either weak or absent, so it is suggested that neither measure the same structures or cognitive processes (Johnco, Wuthrich and Rapee, 2014). While problems such as social desirability (Webster, 2019) may arise in self-report measurements, a more reductionist approach

is used in performance measures, so both approaches have their own advantages and disadvantages. Nevertheless, it is suggested that these two different approaches complement each other (Synder, Friedman and Hankin, 2020).

As a result, a different approach, used in Cambaz and Ünal's study (2021) and suitable for online application in this pandemic period, is used in the performance measurement of cognitive flexibility in this study. Like Barbey, Colom and Grafman (2013), this performance measurement includes processes to produce language. It is planned to compare this measurement taken at different times in university students, before and during the pandemic period, within-subject and between-subjects. Finally, it is aimed to examine the relationship of this cognitive flexibility with vulnerability, perceived risk, and fear in COVID-19.

### Hypotheses

Hypothesis 1 (H1): The cognitive flexibility (H1) and the total number of words produced (H1V2) of students at time T19 are expected to be higher than the levels of students at time T20.

Hypothesis 2 (H2): The cognitive flexibility (H2V1) and the total number of words produced (H2V2) measurements taken from the same students at T20 time are expected to be higher than the students at T21 time.

Hypothesis 3 (H3): There will be a negative relationship between cognitive flexibility and vulnerability, perceived risk and fear regarding COVID-19.

## Materials and Methods

### Participants

The data was collected at three different times (i.e., 2019, 2020, and 2021) from 239 students (207 women (86.6%), for details see Table 1) studying at a state university in Ankara, Turkey. Ethical approval of the study was obtained from Ethics Committee. Participants were invited to the study in return for additional points for the course.

**Table 1**

*Number of participants*

Year	Design	
	Between-subject	Within-Subject
2019	100	16
2020	139	123
2021	-	123
	Total: 239	Total: 123

### Design

#### Dependent variable

Cognitive flexibility and produced total words (collected in T19, T20, and T21), and vulnerability, perceived risk, and fear of COVID-19 (collected only in T21) were the dependent variables of the study.

#### Independent variables

**Within-Subject.** Pre-pandemic (T19), pandemic (T20) and second pandemic (T21) data obtained from the same participants at different times were compared. The within-subject results were obtained by comparing T19 with T20, and T20 with T21.

**Between-Subjects.** Before and after pandemic: 2 (scores before pandemic [T19] x scores during pandemic [T20])

## Measurements

### Cognitive flexibility task

The performance measurement in Cambaz and Ünal's (2021) study was used for assessing cognitive flexibility. The operational definition of cognitive flexibility in this measure is "the ability to benefit from different categories, the number of different categories used, revealing unique semantic relationships" (e.g., Jung-Beeman et al., 2004; Murray et. al, 1990; Rietzschel, De Dreu and Nijstadet, 2007). A total of 40 words from 8 different categories (e.g., school, furniture, emotions), 5 from each category (e.g., student, desk, happy), were presented in a table. The categories used in the table are predetermined and the words from these categories presented as mixed in this table. Thus, an objective approach was demonstrated in determining the different categories used by the participants. The instruction given to the participants is "Please form five different sentences using at least one of the above words, or as many as you want." The cognitive flexibility score of the participants was obtained through the following formula.

$$\sum_{n=1}^5 k_n - 1$$

k = number of different categories used in a sentence

Using one category in a sentence does not generate points because the participants have already been asked to use at least one word. For example, "I feel unhappy." cognitive flexibility score was considered 0 for the sentence. Because in this sentence, only one word from one category was used, and the instructions given to the participants were already stated for them to use at least one word. All participants, without exception, used at least one word in each sentence. For instance, considering the sentence "The cat and dog were playing happily.", three different words from two different categories are used and the cognitive flexibility score for this sentence is 1. Words belonging to the same category used in the same sentence do not produce cognitive flexibility scores. Cognitive flexibility score was calculated as "the number of different categories used in a sentence – 1" within this framework. The total score is obtained by adding the flexibility score generated for all sentences. As a result, cognitive flexibility here is not the use of a word given in the table in a sentence, but the ability of the participants to combine words in different categories, which are more difficult to use together.

### COVID-19 vulnerability, perceived risk, and fear

As in Yıldırım, Geçer and Akgül's (2021) study, vulnerability, perceived risk, and fear measurements were also collected. For vulnerability, the following question was asked to the participants: "In your opinion, what is the probability of developing coronavirus disease during the coronavirus outbreak?". For perceived risk, the participants asked the following question: "Compared to most people your age and sex, what would you say your chances are for developing novel coronavirus?". Lastly, "I am afraid of novel coronavirus" and "I am terrified by a novel coronavirus" was used for fear measurement. All questions were 5-point Likert type, and high scoring for each question indicated higher vulnerability, higher perceived risk, and higher fear, respectively.

### Procedure

Participants were invited to the research via the online form. Participants who approved the consent form first answered the cognitive flexibility task, then the COVID-19 questions (T21) and the demographic form (T19, T20).

## Results

### Reliability of the Measurement

To test the reliability of cognitive flexibility for five different sentences in the T19 data, the Cronbach alpha internal consistency coefficient was examined. The result was .78. The internal consistency coefficient was found as .77 and .73 for the T20 and T21, respectively. To measure the test-retest reliability, the correlation between T20 and T21 data from the same participants was examined. Accordingly, the test-retest correlation coefficient was found to be .64.

### Within-Subject Results

The analysis of the data was performed by using the SPSS v23 statistical analysis program. Below and above 2.5 standard deviations were excluded from the analysis. Paired-sample t-test analysis' results indicated a significant difference in the cognitive flexibility scores between T20 measurement (M = 3.96, SD = 2.82) and the T21 measurement (M = 3.31, SD = 2.55) conditions;  $t(123) = 3.17, p = .00$ . There was a significant difference in the total words scores for between T20 measurement (M = 41.87, SD = 9.77) and the T21 measurement (M = 39.02, SD = 7.75) conditions;  $t(123) = 3.54, p < .001$ .

There was a difference between the cognitive flexibility scores for between T19 measurement (M = 5.50, SD = 1.91) and T20 measurement (M = 4.43, SD = 2.71) for same participants ( $t(13) = 1.10, p = .29$ ) was not significant. However, the total words' scores for T19 measurement (M = 32.86, SD = 11.65) and for T20 measurement (M = 46.21, SD = 10.37) for same participants ( $t(13) = 4.13, p < .001$ ) was significant.

### Between-Subjects Results

The MANOVA test was applied to examine the cognitive flexibility and total word differences of different students whose data were collected at T19 and T20 (gender and age were controlled). According to Box's Covariance Equality Test results ( $F(3, 3431724) = 2.01, p = .11$ ), it was found that the covariance equality assumption was met. According to Levene's Equality of Variance Test results, it was found that the equality of variance assumption was met for cognitive flexibility  $F(1, 237) = .007, p = .94$  and total words ( $F(1, 237) = .38, p = .54$ ).

The different measurement times (T19-T20) had a significant effect in multivariate test ( $\Lambda = .819, F(2, 234) = 25.84$ ). Namely, T19 measurement of cognitive flexibility (N = 99, M = 4.97, SD = 3.01) was significantly higher than T20 measurement (N = 140, M = 3.76, SD = 2.66);  $F(1, 235) = 10.10, p = .00, \eta^2 = .04$ . Also, T19 measurement of total words (N = 99, M = 34.51, SD = 8.99) was significantly lower than T20 measurement (N = 140, M = 41.89, SD = 9.83);  $F(1, 235) = 34.10, p = .00, \eta^2 = .12$ . In other words, students who continued their education with formal education in 2019 used significantly more categories (their flexibility was higher) but they used significantly less words. Gender and age did not cause a significant difference.

### Correlations Among Variables

There is a correlation of .64 between T20 and T21 time of cognitive flexibility, and a correlation of .52 between T20 and T21 times of the total word (see Table 2). There is a correlation of .37 between vulnerability and perceived risk; .23 between vulnerability and cognitive flexibility in T20; -.23 between vulnerability and the total words in T20; and .23 between vulnerability total emotional words in T20. No correlation was found for cognitive flexibility and total word data at T21 time obtained simultaneously with COVID-19 related variables. To examine how the data explains vulnerability, regression analysis was performed.

**Table 2**  
Correlation coefficients

	1	2	3	4	5	6	7	8	9	10	11	12
1. CF-T20	1											
2. CF-T21	.64**	1										
3. TW-T20	.08	-.05	1									
4. TW-T21	.08	.00	.52**	1								
5. TEW-T20	.50**	.30**	.18*	.04	1							
6. TEW-T21	.26**	.42**	-.07	-.04	.39**	1						
7. Vulnerability	.23*	.13	-.23*	-.10	.23**	.08	1					
8. P. Risk	-.04	-.04	-.20	-.09	-.03	.09	.37**	1				
9. Fear	-.10	-.03	-.17	-.02	-.14	-.04	.11	.14	1			
10. P. SEL	-.06	-.09	-.12	-.16	-.03	.17	-.05	-.01	.05	1		
11. Siblings	-.01	-.06	.04	.04	.04	-.01	.10	-.03	-.25**	-.16	1	
12. Age	-.06	-.05	-.08	-.16	-.08	-.04	.13	.01	.03	-.10	.02	1

\*\*  $p < 0.01$ . \*  $p < 0.05$ , CF = cognitive flexibility, T20 = 2020 data, T21 = 2021 data, TW = total word, TEW = total emotional

word, P. Risk = perceived risk, fear, P. SEL = perceived socioeconomic level

### Regression for COVID-19 Vulnerability

The model in Table 3 explains 31% of the vulnerability variance,  $F(11, 112) = 4.67$ ,  $p = .00$  (see Table 3). Accordingly, the perceived risk ( $\beta = .348$ ,  $t = 4.28$ ,  $p = .00$ ) predicts vulnerability. Cognitive flexibility, total word, and total emotional words obtained at the same time (in T21) with the perceived risk variable did not predict vulnerability. Surprisingly, the total word ( $\beta = -.22$ ,  $t = -2.311$ ,  $p = .02$ ) and total emotional words ( $\beta = .24$ ,  $t = 2.48$ ,  $p = .02$ ) obtained from the same participants a month ago (in T20) predicts vulnerability. In other words, performance measurements taken from the participants simultaneously with the vulnerability measurement did not predict vulnerability. Performance measurements (total word and total emotional word) collected a month ago predicted vulnerability. Accordingly, while the total word collected three weeks ago seems to decrease the upcoming perceived vulnerability, the total emotional word used a month ago seems to increase vulnerability.

**Table 3**  
*The model for vulnerability of COVID-19*

	Step 1			Step 2			Step 3			Step 4		
	$\beta$	$\Delta R^2$	$\Delta F$	$\beta$	$\Delta R^2$	$\Delta F$	$\beta$	$\Delta R^2$	$\Delta F$	$\beta$	$\Delta R^2$	$\Delta F$
Sex	.12	.05	1.89	.10	.15	10.80*	.11	.016	.78	.08	.11	5.74*
Age	.14			.11			.11			.12		
Siblings	.09			.12			.11			.13		
Fear				.08			.08			.10		
P. Risk				.37*			.37*			.35*		
CF T21							.13			-.04		
TW T21							.01			.10		
TEW T21							-.01			-.08		
CF T20										.18		
TW T20										-.22*		
TEW T20										.25*		

\*.  $p < 0.05$ , P. Risk = perceived risk, CF = cognitive Flexibility, TW = total word, TEW = total emotional word, T20 = 2020 data, T21 = 2021 data

## Discussion

In this study, a performance measure was used benefiting from the language production processes of cognitive flexibility. This performance measure is also in line with the definition of cognitive flexibility regarding usage of unique semantic relationships (Jung-Beeman et al., 2004). It is understood that this performance measurement, suitable for online application during this pandemic period, gives reliable results. According to Hulin, Netemeyer and Cudeck (2001), 0.6-0.7 levels are acceptable, so although it is a performance measurement, it is understood that the internal consistency coefficient and test-retest coefficient are sufficiently reliable. This test-retest coefficient is even higher than the Turkish version of the Cognitive Flexibility Inventory (Gülüm and Dağ, 2012), which is a self-report measure. Some of the disadvantages mentioned about performance measures are that they require a lot of time and money and their investment in maximal performance in the artificial environment (Coman and Richardson, 2006). However, the current proposed measurement lacks these disadvantages and participants do not have to strain for a maximum performance. So, the flexibility score also depends on a desire that the participants are not aware of. In creativity tests such as AUT and TTCT, the responses of the participants are obtained first, and then the coders try to obtain how many different categories those answers belong to, and with a relatively subjective approach. In this proposed method, the cognitive flexibility score is evaluated within the framework of objective criteria in the sentences.

According to the between-subject findings of the study, the cognitive flexibility of students who continue formal education in 2019 (T19) is higher than that of students who continue distance education in 2020 (T20), thus H1V1 is confirmed. However, the total words produced by students attending formal

education in 2019 is lower than the students who continue distance education in 2020, thus H1V2 is confirmed just the opposite way. In other words, while students in 2019 formed sentences with fewer words around more categories, students in 2020 formed more words with less categories. This finding was confirmed by the within-subject results comparing the T19 and T20 results, where a limited participant was available. In T19 time, the participants produced sentences with fewer words around more categories, compared to the T20. Both within-subject and between-subject research results reveal a pattern like this: students who continued their distance education during the pandemic period used more words around fewer categories, that is, they were stuck around certain categories. This could be considered as a reflection of less cognitive flexibility.

According to the within-subject findings at T20 and T21 times, students produced more cognitive flexibility and total words at T20 than at T21, thus H2V1 and H2V2 is confirmed. One reason for the cognitive flexibility and total word in T20 time is higher than at T21 time may be that the approaching exams in T21 time plays a role as a stressor, since high anxiety is associated with low cognitive flexibility (e.g., [Kalia, Knauff and Hayatbiniet 2020](#); [Park and Moghaddam, 2017](#); [Yu, Yu and Lin, 2020](#)). Exam anxiety during the pandemic period may have caused worse results. Although the data were collected at the same time, no correlation was found between the cognitive flexibility, total word, total emotional used, and COVID-19 variables at T21 time, thus H3 is not confirmed. Also, no correlation was found between perceived risk of COVID-19 and self-reported overall cognitive flexibility ([Kalia, Knauff and Hayatbiniet 2020](#)). Surprisingly, however, regression analysis revealed that vulnerability in T21 was predicted by the total word and total emotional word in T20. The high number of total words in T20 time decreased vulnerability, and the high number of total emotional words in T20 time increased vulnerability in T21. This may mean that expressing ourselves during the pandemic period reduces our vulnerability, but when emotional expression is involved, our vulnerability increases. The study also found that the number of siblings was negatively correlated with the fear of COVID-19. According to the findings of [Ma and Miller \(2020\)](#), perceived social support in students during the pandemic period is negatively related to anxiety and stress. Greater number of siblings may be related with greater perceived social support.

Cognitive flexibility is associated with positive outcomes during the pandemic period (e.g., [Afshari, Hashemikamangar and Hashemikamangar, 2021](#); [Kalia, Knauff and Hayatbiniet 2020](#); [Seiter and Curran, 2021](#)). In the current study, obviously, distance education period plays an important role in reducing students' cognitive flexibility. In addition, stressors such as exam stress could further reduce cognitive flexibility. If conditions such as the loss of a relative are added to this picture, it may be even more difficult to cope with this situation. Therefore, some strategies should be followed to increase the cognitive flexibility of students and make them to adapt to the distance education process in a better way.

The first strategy may be as follows: Social interactions of individuals -within the scope of pandemic possibilities- allow healthy progress. In the current study, it has been shown that the number of siblings is negatively related to the perceived fear of COVID-19. In addition, the vulnerability of the participants who expressed themselves more (producing more total words) after one month was found to be lower. However, the vulnerability of the participants who expressed themselves around emotional words was higher after one month. Therefore, it seems important to provide environments where participants can express themselves without experiencing excessive emotional intensity. In this period, students' access to mental health services should be facilitated, albeit virtual, and social assistance should be provided to students in special situations ([Liu et al., 2020](#)). Online education is proposed to include planning, implementation and reflection stages and there are tasks to be completed in these stages ([Kim, 2020](#)). Kim suggests that even if the transition to normal classroom teaching is difficult in the current situation, the environment, and activities like the classroom environment should be provided in online teaching and important components such as creativity, critical thinking, and communication should be presented to students. Students may have some suggestions to make the lessons more efficient ([Chen, Kaczmarek and Ohyama, 2020](#)). Working with small groups of previously distributed cases could be more beneficial for students than lecture alone. Interactive lessons are also more beneficial and ungraded quizzes can be made useful at this stage so that students can be integrated into the lesson. Interactive teaching style is the main predictor of student satisfaction and effectiveness of teaching ([Fatani, 2020](#)). Students may improve their metacognitive skills (e.g., cognitive flexibility) to better adapt to education in COVID-19 ([Qadir and AlFuqaha, 2020](#)). Qadir and Al-Fuqaha suggest that it may be beneficial for students to have a basic knowledge on the functioning of memory, the connection of neurons with each other, how to learn best and how to consolidate information to improve their meta-cognitive processes.

One limitation of this study is the small number of participants for the within-subject design at T19 and T20 time. In addition, the proposed novel method needs to be studied in different contexts and variables. Not only the quantity but also the quality of the sentences produced by the participants around

certain words may provide meaningful data. Different qualitative structures may occur in the content of sentences according to the number of different categories used. Therefore, qualitative analysis and semantical evaluation of the generated sentences might provide new perspectives. Also, for future studies, it may be suggested to investigate the relationship between different performance measures of cognitive flexibility and the currently proposed performance measurement. While distance education extended the study time of some students, it decreased some, as well (Aucejo, 2020). Examining personality types of participants (e.g., extroverted, or introverted) might help to explain these seemingly contradictory results.

## Conclusion

In this study, a novel approach was used to measure cognitive flexibility. The correlation between the measurements collected at different times points to a disposition, which could be called as trait, for the number of word production and the use of words from different categories. As a result, in a period when the COVID-19 pandemic was experienced so intensively, students seem to get heavily affected both cognitively and emotionally. Current research reveals that cognitive flexibility, which is a metacognitive process, is affected by this process, as well. Accordingly, in this period, students preferred to produce many words around fewer categories, indicating low cognitive flexibility, rather than producing their semantic resources efficiently. However, performance measures such as producing many words or focusing on emotional words as a general dispositional strategy have also been found to predict future vulnerability to COVID-19. More research is needed to examine important psychological resources such as cognitive flexibility that may be affected by this period, and to develop strategies to protect these resources.

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### Conflict of interests

The authors declare no conflict of interest.

## References

- Afshari, A., Hashemikamangar, S., & Hashemikamangar, S. S. (2021). The correlation of perceived stress and professional concerns during COVID-19 pandemic among Iranian dentists: the mediating role of cognitive flexibility. *Dentistry 3000*, 9(1). <https://doi.org/10.5195/d3000.2021.119>
- Almeida, L. S., Prieto, L. P., Ferrando, M., Oliveira, E., ve Ferrándiz, C. (2008). Torrance Test of Creative Thinking: The Question of Its Construct Validity. *Thinking Skills and Creativity*, 3(1), 53-58. <https://doi.org/10.1016/j.tsc.2008.03.003>
- Aucejo, E. M., French, J., Araya, M. P. U., & Zafar, B. (2020). The impact of COVID-19 on student experiences and expectations: Evidence from a survey. *Journal of Public Economics*, 191, 104271. <https://doi.org/10.1016/j.jpubeco.2020.104271>
- Barbey, A. K., Colom, R., & Grafman, J. (2013). Architecture of cognitive flexibility revealed by lesion mapping. *Neuroimage*, 82, 547-554. <https://doi.org/10.1016/j.neuroimage.2013.05.087>
- Bilgin, M. (2009). Developing a cognitive flexibility scale: Validity and reliability studies. *Social Behavior and Personality: An International Journal*, 37(3), 343-353. <https://doi.org/10.2224/sbp.2009.37.3.343>
- Bond, F. W., & Flaxman, P. E. (2006). The ability of psychological flexibility and job control to predict learning, job performance, and mental health. *Journal of Organizational Behavior Management*, 26(1-2), 113-130. [https://doi.org/10.1300/J075v26n01\\_05](https://doi.org/10.1300/J075v26n01_05)
- Byrnes, Y. M., Civantos, A. M., Go, B. C., McWilliams, T. L., & Rajasekaran, K. (2020). Effect of the COVID-19 pandemic on medical student career perceptions: a national survey study. *Medical Education Online*, 25(1), 1798088. <https://doi.org/10.1080/10872981.2020.1798088>
- Cambaz, H. Z., & Ünal, G. (2021). The Effect of Abstract and Concrete Boundaries on Cognitive Flexibility. *Hacettepe University Journal of Faculty of Letters*. <https://doi.org/10.32600/huefd.772811>
- Chen, E., Kaczmarek, K., & Ohyama, H. (2020). Student perceptions of distance learning strategies during COVID-19. *Journal of dental education*. <https://doi.org/10.1002/jdd.12339>
- Ciarrochi, J., Bilich, L., & Godsell, C. (2010). Psychological flexibility as a mechanism of change in acceptance and commitment therapy. In R. A. Baer (Ed.), *Assessing mindfulness and acceptance processes in clients: Illuminating the theory and practice of change* (p. 51–75). Context Press/New Harbinger Publications.
- Coman, L., & Richardson, J. (2006). Relationship between self-report and performance measures of function: a systematic review. *Canadian Journal on Aging/La Revue Canadienne du Vieillessement*, 25(3), 253-270. Retrieved from <https://www.muse.jhu.edu/article/208987>
- Dawson, D. L., & Golijani-Moghaddam, N. (2020). COVID-19: Psychological flexibility, coping, mental health, and wellbeing

- in the UK during the pandemic. *Journal of Contextual Behavioral Science*, 17, 126-134. <https://doi.org/10.1016/j.jcbs.2020.07.010>
- Dennis, J. P., & Vander Wal, J. S. (2010). The cognitive flexibility inventory: Instrument development and estimates of reliability and validity. *Cognitive Therapy and Research*, 34(3), 241-253. <https://doi.org/10.1007/s10608-009-9276-4>
- Fernandez Lynch, H., Dickert, N. W., Zettler, P. J., Joffe, S., & Largent, E. A. (2020). Regulatory flexibility for COVID-19 research. *Journal of Law and the Biosciences*, 7(1), Isaa057. <https://doi.org/10.1093/jlb/Isaa057>
- Fatani, T. H. (2020). Student satisfaction with videoconferencing teaching quality during the COVID-19 pandemic. *BMC Medical Education*, 20(1), 1-8. <https://doi.org/10.1186/s12909-020-02310-2>
- Grubic, N., Badovinac, S., & Johri, A. M. (2020). Student mental health in the midst of the COVID-19 pandemic: A call for further research and immediate solutions. *International Journal of Social Psychiatry*, 66(5), 517-518. <https://doi.org/10.1177/0020764020925108>
- Guilford, J. P. (1967). *The nature of human intelligence*. New York: McGraw-Hill
- Gülüm, İ. V., & Dağ, İ. (2012). The Turkish adaptation, validity and reliability study of the Repetitive Thinking Questionnaire and the Cognitive Flexibility Inventory. *Anatolian Journal of Psychiatry*, 13(3).
- Hill, K., & Fitzgerald, R. (2020). Student perspectives of the impact of COVID-19 on learning. *All Ireland Journal of Higher Education*, 12(2).
- Hulin, C., Netemeyer, R., & Cudeck, R. (2001). Can a reliability coefficient be too high? *Journal of Consumer Psychology*, 55-58.
- Ionescu, T. (2012). Exploring the nature of cognitive flexibility. *New Ideas in Psychology*, 30(2), 190-200. <https://doi.org/10.1016/j.newideapsych.2011.11.001>
- Jafari, A. (2020). Comparing Cognitive Flexibility, Psychological Capital and Coping Strategies with Pain between Individuals with COVID-19 Responding and Non-Responding to Home Treatment. *Journal of Counseling Research*, 19(74), 4-35. <https://doi.org/10.29252/jcr.19.74.4>
- Johnco, C., Wuthrich, V. M., & Rapee, R. M. (2014). Reliability and validity of two self-report measures of cognitive flexibility. *Psychological Assessment*, 26(4), 1381. <https://doi.org/10.1037/a0038009>
- Jung-Beeman, M., Bowden, E. M., Haberman, J., Frymiare, J. L., Arambel-Liu, S., Greenblatt, R., ... & Kounios, J. (2004). Neural activity when people solve verbal problems with insight. *PLoS Biol*, 2(4), e97. <https://doi.org/10.1371/journal.pbio.0020097>
- Kalia, V., Knauff, K., & Hayatbini, N. (2020). Cognitive flexibility and perceived threat from COVID-19 mediate the relationship between childhood maltreatment and state anxiety. *PLoS One*, 15(12), e0243881. <https://doi.org/10.1371/journal.pone.0243881>
- Kashdan, T. B., & Rottenberg, J. (2010). Psychological flexibility as a fundamental aspect of health. *Clinical Psychology Review*, 30(7), 865-878. <https://doi.org/10.1016/j.cpr.2010.03.001>
- Kim, J. (2020). Learning and teaching online during Covid-19: Experiences of student teachers in an early childhood education practicum. *International Journal of Early Childhood*, 52(2), 145-158. <https://doi.org/10.1007/s13158-020-00272-6>
- Kongs, K.S., Thompson, L.L., Iverson, G.L. ve Heaton, R.K. (2000). *Wisconsin card sorting test-64 card version (WCST-64)*. Psychological Assessment Resources, Odessa.
- Kroska, E. B., Roche, A. I., Adamowicz, J. L., & Stegall, M. S. (2020). Psychological flexibility in the context of COVID-19 adversity: Associations with distress. *Journal of Contextual Behavioral Science*, 18, 28-33. <https://doi.org/10.1016/j.jcbs.2020.07.011>
- Lehto, J. E., Juujärvi, P., Kooistra, L., & Pulkkinen, L. (2003). Dimensions of executive functioning: Evidence from children. *British Journal of Developmental Psychology*, 21(1), 59-80. <https://doi.org/10.1348/026151003321164627>
- Liu, C. H., Pinder-Amaker, S., Hahm, H. C., & Chen, J. A. (2020). Priorities for addressing the impact of the COVID-19 pandemic on college student mental health. *Journal of American College Health*, 1-3. <https://doi.org/10.1080/07448481.2020.1803882>
- Ma, H., & Miller, C. (2020). Trapped in a double bind: Chinese overseas student anxiety during the COVID-19 pandemic. *Health Communication*, 1-8. <https://doi.org/10.1080/10410236.2020.1775439>
- Matheson, G. J. (2019). We need to talk about reliability: making better use of test-retest studies for study design and interpretation. *PeerJ*, 7, e6918. <https://doi.org/10.7717/peerj.6918>
- McCracken, L. M., & Morley, S. (2014). The psychological flexibility model: a basis for integration and progress in psychological approaches to chronic pain management. *The Journal of Pain*, 15(3), 221-234. <https://doi.org/10.1016/j.jpain.2013.10.014>
- Murray, N., Sujan, H., Hirt, E. R., & Sujan, M. (1990). The influence of mood on categorization: A cognitive flexibility interpretation. *Journal of Personality and Social Psychology*, 59(3), 411. <https://doi.org/10.1037/0022-3514.59.3.411>
- Pakenham, K. I., Landi, G., Bocolini, G., Furlani, A., Grandi, S., & Tossani, E. (2020). The moderating roles of psychological flexibility and inflexibility on the mental health impacts of COVID-19 pandemic and lockdown in Italy. *Journal of Contextual Behavioral Science*, 17, 109-118. <https://doi.org/10.1016/j.jcbs.2020.07.003>
- Park, J., & Moghaddam, B. (2017). Impact of anxiety on prefrontal cortex encoding of cognitive flexibility. *Neuroscience*, 345, 193-202. <https://doi.org/10.1016/j.neuroscience.2016.06.013>
- Qadir, J., & Al-Fuqaha, A. (2020). *A student primer on how to thrive in post-COVID-19 engineering education*.
- Raaper, R., & Brown, C. (2020). The Covid-19 pandemic and the dissolution of the university campus: Implications for student support practice. *Journal of Professional Capital and Community*. <https://doi.org/10.1108/JPC-06-2020-0032>
- Rietzschel, E. F., De Dreu, C. K., & Nijstad, B. A. (2007). Personal need for structure and creative performance: The moderating influence of fear of invalidity. *Personality and Social Psychology Bulletin*, 33(6), 855-866. <https://doi.org/10.1177/0146167207301017>
- Scott, W. A. (1962). Cognitive complexity and cognitive flexibility. *Sociometry*, 405-414. <https://doi.org/10.2307/2785779>
- Seiter, J. S., & Curran, T. (2021). Social-distancing fatigue during the COVID-19 pandemic: a mediation analysis of cognitive flexibility, fatigue, depression, and adherence to CDC guidelines. *Communication Research Reports*, 1-11. <https://doi.org/10.1080/08824096.2021.1880385>
- Snyder, H. R., Friedman, N. P., & Hankin, B. L. (2020). Associations Between Task Performance and Self-Report

- Measures of Cognitive Control: Shared Versus Distinct Abilities. *Assessment*, 1073191120965694. <https://doi.org/10.1177/1073191120965694>
- Webster, J. D. (2019). Self-report wisdom measures: Strengths, limitations, and future directions. In R. J. Sternberg & J. Glück (Eds.), *The Cambridge handbook of wisdom* (p. 297–320). Cambridge University Press. <https://doi.org/10.1017/9781108568272.015>
- Whiting, D. L., Deane, F. P., Simpson, G. K., McLeod, H. J., & Ciarrochi, J. (2017). Cognitive and psychological flexibility after a traumatic brain injury and the implications for treatment in acceptance-based therapies: A conceptual review. *Neuropsychological Rehabilitation*, 27(2), 263-299. <https://doi.org/10.1080/09602011.2015.1062115>
- Yıldırım, M., Geçer, E., & Akgül, Ö. (2021). The impacts of vulnerability, perceived risk, and fear on preventive behaviours against COVID-19. *Psychology, Health & Medicine*, 26(1), 35-43. <https://doi.org/10.1080/13548506.2020.1776891>
- Yu, Y., Yu, Y., & Lin, Y. (2020). Anxiety and depression aggravate impulsiveness: the mediating and moderating role of cognitive flexibility. *Psychology, Health & Medicine*, 25(1), 25-36. <https://doi.org/10.1080/13548506.2019.1601748>

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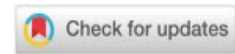
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## Cognitive Constructivist Way of Teaching Scientific and Technical Contents

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**Abstract:** For pupils to obtain high-quality and permanent knowledge, it is important that the teaching of scientific and technical contents is based on cognitive constructivist approach. We carried out a research, during which we asked three research questions, on a sample of 167 class teachers in the Republic of Slovenia. We wanted to find out: how often class teachers included elements typical of cognitive constructivist approach; was the frequency of using elements of cognitive constructivist teaching model linked to the teacher's concern for their own professional development, and was the frequency of using elements of cognitive constructivist teaching model linked to the factors, such as the teacher's estimated importance, difficulty and necessity of Science and Technics, the assessment of their own competence and professional enthusiasm. Data were collected with three scales: ways of teaching scientific and technical contents; attitude to scientific and technical contents and teaching and components of professional development. Data were processed according to descriptive and inferential statistics. The research showed that the formulation and verification of hypotheses, two important elements in view of cognitive constructivist teaching model, were less often represented. With statistically significant higher frequency they were organized by teachers, who rated their competence higher, were more enthusiastic and cared more about their professional development.

**Keywords:** cognitive constructivist teaching model, science and technics, competence, professional enthusiasm, professional development.

### Introduction

In today's highly developed technological world, in the time of fast and unpredictable technological changes, a relevant technological competence is of fundamental importance for people. Social and economic changes challenge expert consideration on the importance of technology and the ways of education that will, along the entire vertical of national school systems: from pre-school to post-graduate education, enable its achievement. It is important to achieve technological literacy in each individual.

Johnson (1989) defines Technology as "the application of knowledge, tools, and skills to solve practical problems and extend human capabilities" (p.13), and states that it is enhanced by the discoveries of science and shaped by the designs of engineering. When defining technology, various researchers (McRobbie, Ginns, and Stein, 2000; Gardner, Penna, and Brass, 1996; Johnson, 1989; Jones and Carr, 1992) point out the following: a) technology is a process; b) it has a human dimension; c) technology is situated (it is conducted within contexts and constraints); d) it includes a social dimension; and (e) it leads to the development of products or artefacts.

For quality teaching of contents related to natural sciences and technology it is essential for teachers to have in-depth knowledge of technology that encompasses all of the five dimensions; while also their conceptions are important.

Research has shown that teachers' beliefs are a strong determinant of teachers' behaviour. Teachers' perceptions of subject discipline and their conceptions of teacher and student role have an important impact on the teachers' decision-making and teaching (Šteh Kure, 1999; Valenčič Zuljan, 2007; Tigchelaar, Brouwer, and Vermunt, 2010). For example, a teacher who saw himself as the guardian of conventional wisdom in science adopted a transmission model of teaching in the classroom and talked about imparting a desired amount of knowledge (McRobbie and Tobin, 1995, as cited in McRobbie, Ginns,

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[McRobbie, Ginns, and Stein, 2000](#)).

For quality teaching of scientific and technical contents, teachers' didactic competencies are essential. In their review of several studies on learning and meta-studies on teaching efficiency, [Dumont and Istance \(2013\)](#) emphasize how important it is to form efficient and innovative learning environments.

Characteristics of efficient learning environments are: a) in such environments the teacher knows each individual student and performs differentiation and individualization; b) such environments promote optimal mental and emotional activity in each pupil; c) they create collaborative learning and collaborative climate; d) they promote innovativeness and openness and include authentic problems and different ways of research; e) they promote learning of learning and conceive the independence of pupils ([Valenčič Zuljan, 2016](#)).

The formation of efficient and innovative learning environments requires professional and well considered selection and complementation of various didactic strategies, teaching methods and ways of working. In their meta-analysis of effective teaching, [Marzano, Pickering, and Pollock \(2006\)](#) refer to the ways of working that have a significant impact on pupils' achievements. They highlight pupil-centred strategies, such as summarizing, taking notes, cooperative learning, setting goals and giving feedback, formulating and testing hypotheses, asking questions and giving cues. Combining various teaching methods and forms of learning to reach predefined goals enables the individualization of learning process, i.e., adapting classes to different pupils ([Mattes, 2007](#); [Strmčnik, 2001](#); [Blažič et al., 2003](#); [Plešec Gasparič and Valenčič Zuljan, 2019](#); [Valenčič Zuljan and Kalin, 2020](#)). It is a complex and important competence that develops, according to research findings, during higher stages of teachers' professional development ([van der Lans, van de Griff, and van Veen, 2017](#); [Pečar, 2018](#)).

In reference to either earlier studies of 'teacher effectiveness' school or more recent international comparative studies, numerous researchers are pointing at the effectiveness of direct instruction or whole class teaching ([Rosenshine, 1979](#); [Reynolds and Farrell, 1996](#); [Miao et al., 2015](#); [Hattie, 2009, 2018](#); [Muijs and Reynolds, 2002](#)). [Muijs and Reynolds \(2017\)](#) define direct instruction as the way of work where the teacher conveys learning contents directly through teaching the whole class, while they point out that this is not only frontal teaching, but also constant autonomous learning work which plays a key role in pupils' effective learning and knowledge. In this context, [Valenčič Zuljan and Kalin \(2020\)](#) use the term traditional teaching (as opposed to open teaching), as they want to emphasize it is classical from the historical point of view, and as they also want to point out the quality of this way of work in attaining certain educational goals. Traditional teaching has proved to be effective to obtain basic knowledge, skills and rules ([Brophy and Good, 1986](#); [Good and Brophy, 2003](#)), but less so to acquire more complex and creative contents where the didactic strategies of open teaching are more effective. The term open teaching has been introduced by [Strmčnik \(2001\)](#). [Valenčič Zuljan and Kalin \(2020\)](#) define the term more in detail. They perceive openness from several points of view: openness to recognize and take into account different characteristics of pupils; openness when looking for optimum in terms of pupils' characteristics and teaching contents; openness in the use of sources and spaces; teaching not only in school premises and classrooms but also outside (field work, excursions, outdoor teaching, learning through project work, pupils' research work, authentic learning); openness regarding the cooperation of various profiles of educators and other experts (team teaching, cooperation with researchers, artists, cultural creators, scientists, etc.), openness of the teacher's and pupil's roles (flexible alternating of direct and indirect teaching, teachers can also assume more of a mentor's role, pupils can engage in peer teaching) etc.... and also openness in combining didactic strategies. In order to achieve technological literacy in each pupil, it is thus important for the teacher to make, while taking account of learning goals and contents as well as pupils' characteristics, a professionally well considered selection and combination of didactic strategies (project and problem teaching, problem and traditional teaching, etc.) and to form encouraging and innovative learning environment. As exposed by [Vujičić, Pejić-Papak, and Valenčič-Zuljan \(2020, p. 29\)](#) "Effective learning setting requires a meaningful combination of individual, frontal and group learning forms, inter-twining pupils' independent work with group work, team cooperation among teachers and other professionals, establishing partner relationship between school and broader environment". When teaching scientific and technical contents, the experientially oriented instruction has an important role. According to [Blažič et al. \(2003\)](#), it has a long tradition, since it was highlighted by educators who derived from empiricism and sensualism (such as Comenius), and educators who relied on rationalism. According to Marks and Walter (1981, as cited in [Marentič Požarnik, 1987](#)), the basic premise of experiential learning is that we learn the best when we do something ourselves. [Kolb \(1984\)](#), who developed the experiential learning model, defines the experiential learning as every learning where pupils are in direct contact with reality they study. He emphasizes that this is learning as 'the process whereby knowledge is created through the transformation of experience. Knowledge results from the

combination of grasping and transforming experience' (Kolb, 1984, p. 41). "This process is portrayed as an idealized learning cycle or spiral where the learner 'touches all the bases' – experiencing, reflecting, thinking, and acting" (Kolb and Kolb, 2009, p. 44). Various studies on the effects of experientially oriented learning in Science and Technics were carried out at various levels of schooling (Abdulwahed and Nagy, 2009; Dzan et al., 2015; Crompton, 2020; Cotic et al., 2020). Cotic et al. (2020) examined the effect of an experiential learning model (The Mobile Natural Science Learning - MNSL) on the knowledge of 4th grade primary school students in Slovenia, during natural science school lessons at the seashore through the use of tablets. Mobile technology provides authentic learning, assisting outdoor lessons providing material and environmental context in learning, which support the experience of a learner. Findings indicate that the MNSL-model had a positive effect on students' achievement in science, more precisely in knowledge on marine organisms and life at the seashore.

Several researchers studied the impact of instructional methods on students' attitudes toward technology and knowledge (Boser, Palmer, and Daugherty, 1998; Lin et al., 2020). In further text we refer to the examples of studies that in various ways emphasize the importance of connecting various didactic strategies and learning methods.

For the development of scientific and technological literacy it is crucial that learners (children and young people) get familiar with basic scientific and technical conceptions, support them with facts and connect them in a network of knowledge.

In teaching, the explanation method significantly contributes to the clarity and systematic nature of basic conceptions and rules, and the conversation and discussion methods of teaching help verify student's understanding, putting the contents in different perspectives, opening unsolved questions (Valenčič Zuljan and Kalin, 2020), while including inter-subject connections. When teaching scientific and technical contents, drawing and modelling are also important (Valenčič Zuljan and Kalin, 2020; Anning, 1997; Hallström, Elvstrand, and Hellberg, 2015). Mawson (2010) found that opportunities for pupils to draw as a form of technical activity are lacking. As he exposes, learning various techniques of drawing and modelling would enable students to obtain technical language useful to express their ideas. Teaching methods of written works and of work with texts are also important in achieving scientific and technical literacy. Ritchie, Tomas, and Tones (2011) refer to the importance of pupils' activity and creativity in writing and reading. Several researchers (Hand and Prain, 1995, as cited in Ritchie, Tomas, and Tones, 2011; Prain and Hand, 1996, 1999, as cited in Ritchie, Tomas, and Tones, 2011), found that diversified writing tasks, including more imaginative writing, have been shown to assist students' learning processes, improve learning outcomes, have strong motivating effects, and impact positively on students' attitudes and engagement. In this context, the use of student-generated narratives is important. While narrative writing is not traditionally connected to teaching Science and Technics, it attracts pupils and has encouraging effect on them. Wellington and Osborne (2001, as cited in Ritchie, Tomas, and Tones, 2011) think that it helps children express their thoughts in written language through being personally engaged (p. 76), it also offers opportunities to connect personal experiences with science ideas (Hand et al., 2001, as cited in Ritchie, Tomas, and Tones, 2011; Hodson, 2009, as cited in Ritchie, Tomas, and Tones, 2011). Moreover, Avraamidou and Osborne (2009) seriously reflect on the question: How can the conceptual complexity of scientific information be translated into 'everyday' language without minimizing its value? A challenge for teachers, according to Vosniadou et al. (2001) should be the creation of interesting and challenging learning environments where teachers will encourage students to actively participate and direct themselves towards their own goals, building and nurturing the students' natural desire to explore. Mihaliček (2011) states that encouraging learning environment and the use of modern didactic strategies contribute not only to the quality of teaching, but also to the satisfaction of pupils and their teacher. He exposes it as an important teacher's competence.

McRobbie, Ginns, and Stein (2000) emphasize that teachers should be able to plan and implement learning experiences that would engage students in the generation and evaluation of ideas, and the use and evaluation of design practices to construct a technological artefact. Despite the importance attributed to the teaching method for practical work, activities and products, when pupils make artefacts, get to know various materials and acquire skills within the framework of technology education, the education process should not remain at that level only. Mawson (2007) points that in teaching Science and Technics great emphasis is on making artefacts, while the discussions on broader questions regarding the nature of technology and connections between technology and society are less frequent. (Mawson, 2010, p. 10) The latter is particularly important for the development of pupils' technology literacy.

Twyford and Järvinen (2000) point at the value of problem teaching that "brings authenticity to classroom experiences for pupils". Technological problem solving is a form of reflective thinking in which the child interacts with many sources of knowledge in the process of solving a problem. The pupil's mind

changes and develops through active participation.

When teaching scientific and technical activities, particularly in younger pupils, the play-based learning method is also important. [Boser, Palmer and Daugherty \(1998\)](#) and [Wolters \(1989\)](#) found the greatest impact on developing a positive attitude toward technology was playing with technological toys, such as LEGOs, Tinkertoys, and Erector Sets.

[Turja, Endepohls-Ulpe and Chatoney \(2009\)](#) have established that not many studies research the play-based method in the context of technological education. When teaching scientific and technical contents to younger pupils, it is possible to apply role playing in various contents: pupils meet various professions, through play, they can get experiences on objects, materials and physical phenomena, through research and tasks, they learn to use tools and accessories ([Turja, Endepohls-Ulpe and Chatoney, 2009](#)). There can be individual or group play, which can be (psychomotor) skill-oriented or creative, focused on problem solving etc. [Parker-Rees \(1997\)](#) believes there are structural similarities between free play and design and technological activities, their common feature being encouraging creativity and critical thinking in problem solving. Play can contribute to language development and connecting abstract concepts and ideas with technological objects that are used during play. Free play can stimulate the ability to visualize or a certain kind of cognitive modelling, important in designing and technological activities ([Parker-Rees, 1997](#)).

The organization of cognitive-constructivist model of teaching is essential for quality when teaching sciences and technical contents ([Yager, 1991](#); [Valenčič Zuljan, 2002](#), [Orbanić Dolenc, Dimec and Cencič, 2016](#); [Akçay and Yager, 2010](#); [Twyford and Jarvinen, 2000](#); [Fox-Turnbull and Snape, 2011](#)). Several studies have shown that cognitive-constructivist model of teaching improves the students' learning outcomes ([Kim, 2005](#); [Çalik et al., 2007](#); [Cakici and Yavuz, 2010](#); [Orbanić Dolenc, Dimec and Cencič, 2016](#)) and increases students' interest for science ([Parker and Gerber, 2000](#)).

Constructivist views are based on the research performed by many authors, such as Piaget, Vygotsky, Dewey ([Marentič Požarnik, 2018](#)). Piaget mostly derived from processes that a person uses to construct the understanding of the world; while Vygotsky - the founder of social constructivism, rather emphasizes the importance of dialogue in knowledge building ([Marentič Požarnik and Cencič, 2003](#)). In spite of different views constructivist-oriented researchers have, they share their emphasizing that individuals actively constructs their cognitive structures, when interpreting their own experiences in particular situations ([Palincsar, 1998](#)) or that learning means an active mental process, in which pupils themselves transform information into meaningful knowledge ([Phillips, 1995](#)). The teachers' role is to design a complex, challenging learning environment with original authentic tasks ([Muijs and Reynolds, 2017](#)), and to encourage and accept student autonomy ([Moustafa, Ben-Zvi-Assaraf and Eshach, 2013](#)).

It is pupil-oriented teaching ([Valenčič Zuljan, 2002](#); [Wilen, Hutchison and Ishler, 2008](#); [Muijs and Reynolds, 2017](#)) that emphasizes the importance of didactic principle of activity and individualization. Therefore, teachers should know children's concepts and experiences in addition to wrong and incomplete perceptions and consider them within the learning process. A teacher forms situations of socio-cognitive conflict and in the process of modelling offers children suitable support in solving the conflict. The teacher's support in cognitive conflict resolution and in the whole process of learning is very important ([Valenčič Zuljan, 2002](#); [Manentič Požarnik and Cencič, 2003](#)). For quality learning, children should be able to acquire the knowledge according to different ways and various activities in a stimulating and innovative learning environment with a proper balance between individual and group work, research and discovering, and the teacher's systematic guidance and moderating ([Barron and Darling-Hammond, 2013](#)).

## Materials and Methods

Deriving from the meaning of cognitive-constructivist teaching model ([Yager, 1991](#); [Akçay and Yager, 2010](#); [Valenčič Zuljan, 2002](#); [Marentič Požarnik, 2004, 2018](#); [Marentič Požarnik and Cencič, 2003](#); [Gojkov, 2009](#)) and various studies on technological education ([Mawson, 2007, 2010, 2013](#); [Fleer, 2000](#); [Stables, 1997](#); [Hallström, Elvstrand and Hellberg, 2015](#)), we wanted to know to which extent class teachers include elements of cognitive-constructivist model when teaching scientific and technical contents.

Deriving from the research problem, we formed three research questions:

1. When teaching scientific and technical contents, how often do class teachers introduce elements of cognitive-constructivist model?
2. Is the frequency of implementing elements of cognitive-constructivist teaching model connected to the teachers' concern about their own professional development?
3. Is the frequency of implementing elements of cognitive-constructivist teaching model connected

to the following factors: The importance of scientific and technical contents; Need for Science and Technics education; Competence for quality teaching in Science and Technics; Professional enthusiasm, and Complexity of teaching Science and Technics.

In our research, we used quantitative research approach and descriptive and causal non-experimental method of educational research.

The research included 167 class teachers from various primary schools in the Republic of Slovenia. Data were collected with three scales: a) ways of teaching scientific and technical contents; b) attitude to scientific and technical contents and teaching; c) components of professional development. We used the instrument, developed in the project "Culture of Educational Institution as a Factor in Co-Construction of Knowledge," and adapted it to our needs. 10 new statements were added to the scale Ways of teaching scientific and technical contents that was developed in the project and originally had 6 items. A factor analysis was carried out and Cronbach's reliability coefficients calculated for the new 16 item scale. The Cronbach's alpha reliability coefficients are as follows: the first factor (Importance of scientific and technical contents) .792; the second factor (Need for scientific and technical education) .798; the third factor (Competence for quality scientific and technical education) .674, the fourth factor (Professional enthusiasm) .719; and the fifth factor (Difficulty of teaching Science and Technics) .502.

Data were processed according to descriptive and inferential statistics. The data were processed in the IBM SPSS Statistics Version 27 statistical package. Correlation coefficients (  $\rho$  ) and factor analysis were used.

Factor analysis was carried out on the scale Attitude towards scientific and technical contents and teaching, consisting of 16 statements. The statements were abstracted into substantively five meaningful factors (KMO = 0.799; Bartlett's test of Chi-Square sphericity = 927.435 with  $p = .000$ ). The method of factor extraction "Principal Component Analysis" was selected. The method of factor rotation is "Varimax with Kaiser Normalisation". The reliability coefficient of this scale is Cronbach's alpha .850. Table 1 presents eigenvalues, explained variances and the number of factors obtained. Table 2 presents the matrix of factors (a set of factors).

**Table 1**  
*Eigenvalues, explained variances and the number of factors obtained*

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.231	32.693	32.693	5.231	32.693	32.693
2	1.727	10.796	43.490	1.727	10.796	43.490
3	1.415	8.843	52.332	1.415	8.843	52.332
4	1.112	6.952	59.284	1.112	6.952	59.284
5	1.057	6.609	65.893	1.057	6.609	65.893
6	0.868	5.428	71.321			
7	0.775	4.844	76.164			
8	0.671	4.196	80.360			
9	0.594	3.714	84.075			
10	0.565	3.531	87.605			
11	0.439	2.742	90.348			
12	0.414	2.586	92.933			
13	0.345	2.154	95.088			
14	0.322	2.014	97.102			
15	0.258	1.614	98.716			
16	0.206	1.284	100.000			

**Table 2**  
*Matrix of factors (set of factors)*

Variables	Factors:				
	1	2	3	4	5
Natural and technical sciences are the basis of social development and progress.	<b>0.850</b>				
Society progress is based on research in natural and technical sciences.	<b>0.823</b>				
If a child is successful in learning, it is sensible to guide them towards natural and technical sciences.	<b>0.644</b>	0.458			
The goal of engaging in natural and technical sciences is to enrich general human culture.	<b>0.548</b>			0.357	0.308
Natural sciences and technology in primary school are needed to enable pupils to decide on their further education.		<b>0.795</b>			
Science and Technics must be represented in primary-school education as early as possible.		<b>0.651</b>		0.525	
Scientific and technical contents are indispensable for pupils' full development.		<b>0.642</b>		0.541	
Education in scientific and technical domains is needed to increase pupils' engagement in solving technology problems of modern society.	0.307	<b>0.598</b>	0.337		
I have enough knowledge to provide pupils quality support in their research and operation of scientific and technical projects within the context of teaching.			<b>0.822</b>		
In my view, I can properly assist pupils who cannot find a solution when solving science tasks.			<b>0.768</b>		
I do fine when I lead discussions related to scientific and technical contents.			<b>0.526</b>		
I am fond of teaching Science and Technics.				<b>0.801</b>	
I can motivate pupils for scientific and technical contents.			.398	<b>0.651</b>	
In my view, scientific and technical contents are demanding for teaching.					<b>0.782</b>
Teaching scientific and technical contents is demanding because of additional space and material requirements.					<b>0.770</b>
Teachers who lack experiences with teaching scientific and technical contents should receive additional training in this domain.		0.319	0.356		<b>0.395</b>

Note: Extraction method: Principal Component Analysis. Rotation method: Varimax with Kaiser Normalization.

The table shows only values above 0.2. Factor loadings are bold.

### Descriptions of factors obtained

Factor 1 - entitled Importance of scientific and technical contents explains 32.693% variance of factor space. Factor 2 - entitled Need for scientific and technical education explains 10.796% of total variance. Factor 3 - entitled Competence for quality scientific and technical education explains 8.843% of total variance. Factor 4 - entitled Professional enthusiasm explains 6.952% of total variance. Factor 5 - entitled Difficulty of teaching Science and Technics explains 6.609% of total variance.

## Results

### Frequency of implementing various elements of cognitive constructivist way of teaching scientific and technical contents

Teachers assessed 6 statements that defined elements of cognitive constructivist way of teaching scientific and technical contents. Since the cognitive constructivist way of teaching points out mental activities of pupils, all the statements were designed so that they originated in the descriptions deriving from pupils' activities.

When forming individual statements we relied on various descriptions of cognitive constructivist model (Sparks-Langer et.al., 2000; Valenčić Zuljan, 2002), that emphasize the importance of pupils' activities in collecting information to test hypotheses, in reflective observation and asking questions, formation of hypotheses, performance of various experiments, verification of hypotheses, as well as the analysis and generalization of conclusions.

**Table 3**

*The shares of assessed frequency of implementing various elements in teaching scientific and technical contents*

Statement:		1	2	3	4	5	M
	PUPILS	I never do	I rarely do	I do at times	I often do	I do very often	SD
1. Perceive phenomena and ask questions.	<i>f</i>	1	2	30	95	41	4.02
	<i>f</i> (%)	0.6	1.2	17.8	<b>56.2</b>	24.3	0.72
2. Collect information with research problem tasks.	<i>f</i>	2	7	56	90	14	3.63
	<i>f</i> (%)	1.2	4.1	33.1	<b>53.3</b>	8.3	0.74
3. Formulate assumptions (hypotheses) on possible answers to questions or solutions to problems.	<i>f</i>	9	61	81	17	1	3.63
	<i>f</i> (%)	5.3	36.1	<b>47.9</b>	10.1	0.6	0.74
4. Examine assumptions	<i>f</i>	4	35	99	29	2	3.91
	<i>f</i> (%)	2.4	20.7	<b>58.6</b>	17.2	1.2	0.68
5. Carry out experiments.	<i>f</i>	1	7	43	81	37	3.86
	<i>f</i> (%)	0.6	4.1	25.4	<b>47.9</b>	21.9	0.82
6. Analyze obtained results and draw conclusions.	<i>f</i>	3	41	87	37	1	3.94
	<i>f</i> (%)	1.8	24.3	<b>51.5</b>	21.9	0.6	0.73

The table 3 shows that in no item grade 5 appears in the first position - I do very often (regularly), somewhat higher rate appears in items Pupils perceive phenomena and ask questions (24.3%) and Pupils carry out experiments (21.9%). Grade 4 – I do often appears in the first position / with the highest share in three items: Pupils perceive phenomena and ask questions (56.2%), Pupils collect information with research problem tasks (53.0%) and Pupils carry out experiments (47.9%). Grade 3 – I do at times figures first in three items: Pupils formulate assumptions (hypotheses) on possible answers to questions or solutions to problems (47.9%); Pupils examine assumptions (58.6%), and Pupils analyze obtained results and draw conclusions (51.5%). Grade 2 – I do rarely has a somewhat higher share in three items: Pupils formulate assumptions (hypotheses) on possible answers to questions or solutions to problem (36.1%); Pupils examine assumptions (20.7%), and Pupils analyze obtained results and draw conclusions (24.3%).

### Is the frequency of implementing various elements of cognitive-constructivist way of teaching scientific and technical contents connected to teachers' concern of their own professional development?

We wanted to know whether the frequency of implementing various elements of cognitive-constructivist way of teaching scientific and technical contents was connected to the teachers' concern of their own professional development, and this was covered in two items: using new scientific research

findings in the domain of learning, teaching and other subject matter and reflecting on their own pedagogical practice.

**Table 4**  
*Assessing items on teachers' concern of their own professional development*

Statement:		1 Not typi- cal at all	2 Mostly not typical	3 I cannot say	4 Mostly typical	5 Absolutely typical	<i>M</i> <i>SD</i>
In my work, I use new scientific research findings from the domains of learning, teaching and other subject matter.	<i>f</i>	1	9	30	109	19	3.80
	<i>f</i> (%)	0.6	5.3	17.8	<b>64.5</b>	11.2	0.72
I regularly reflect on my own pedagogical practice.	<i>f</i>	1	9	41	95	22	3.76
	<i>f</i> (%)	0.6	5.3	24.3	<b>56.2</b>	13.0	0.76

In both items grade 4 occupies the largest share (Table 4) – Mostly typical 64.5% of teachers estimate to be “mostly” typical for them to use new scientific research findings from the domains of learning, teaching and other subject matter, and 56.2% to be mostly typical for them to regularly reflect on their own pedagogical practice. Grade 5 - absolutely typical with its share of 11.2% appears for item “In my work, I use new scientific research findings from the domains of learning, teaching and other subject matter” and with 24.3% share for the statement I regularly reflect on my own pedagogical practice.

**Table 5**  
*Correlation coefficient (  $\rho$  ) between the teacher's concern for their own professional development and the frequency of implementing various ways of teaching scientific and technical contents*

Elements: PUPILS		Using new findings	Reflecting on their own practice
1. Perceive phenomena and ask questions	$\rho$	<b>.181*</b>	<b>.222**</b>
	<i>p</i>	.019	.004
	<i>N</i>	167	168
2. Collect information with research problem tasks	$\rho$	.106	<b>.218**</b>
	<i>p</i>	.172	.004
	<i>N</i>	167	168
3. Formulate assumptions (hypotheses) on possible answers to questions or solutions to problems	$\rho$	.080	<b>.251**</b>
	<i>p</i>	.306	.001
	<i>N</i>	166	167
4. Examine assumptions	$\rho$	<b>.197*</b>	<b>.213**</b>
	<i>p</i>	.011	.006
	<i>N</i>	165	166
5. Carry out experiments	$\rho$	<b>.153*</b>	.093
	<i>p</i>	.049	.233
	<i>N</i>	167	168
6. Analyze obtained results and draw conclusions.	$\rho$	<b>.244**</b>	.151
	<i>p</i>	.002	.052
	<i>N</i>	166	167

\*  $p < .05$ . \*\*  $p < .01$ .

Teachers who regularly reflect on their own pedagogical practice, statistically significantly more often organize classes, where pupils perceive phenomena and ask questions ( $p = .004$ ); collect information with

research problem tasks ( $p = .004$ ); formulate assumptions (hypotheses) on possible answers to questions or solutions to problems ( $p = .001$ ); and examine assumptions ( $p = .006$ ). Teachers who teach using new scientific research findings from the domains of learning, teaching and other subject matter, statistically significantly more often organize classes, where pupils perceive phenomena and ask questions ( $p = .019$ ); examine assumptions ( $p = .011$ ); carry out experiments ( $p = .049$ ); and analyze obtained results and draw conclusions ( $p = .002$ ) (Table 5).

### Correlations between factors and the frequency of implementing various elements of cognitive constructivist way of teaching scientific and technical contents

We were interested whether factors Importance of scientific and technical contents (factor 1); Need for scientific and technical education (factor 2); Competence for quality scientific and technical education (factor 3); Professional enthusiasm (factor 4), and Difficulty of teaching Science and Technics (factor 5) are statistically significantly connected to the frequency of implementing various elements of cognitive constructivist way of teaching.

**Table 6**

Correlation coefficients (  $\rho$  ) between factors and the frequency of implementing various ways of teaching scientific and technical contents

Elements: PUPILS	Factor:					
	1	2	3	4	5	
1. Perceive phenomena and ask questions	$\rho$	-.089	.064	<b>.251**</b>	<b>.200*</b>	.130
	$p$	.259	.415	.001	.010	.098
	$N$	163	163	163	163	163
2. Collect information with research problem tasks	$\rho$	.038	.117	<b>.290**</b>	.129	.030
	$p$	.633	.136	.000	.099	.705
	$N$	163	163	163	163	163
3. Formulate assumptions (hypotheses) on possible answers to questions or solutions to problems	$\rho$	.004	.010	<b>.250**</b>	.131	.074
	$p$	.962	.895	.001	.098	.347
	$N$	162	162	162	162	162
4. Examine assumptions	$\rho$	.021	.125	<b>.210**</b>	<b>.196*</b>	<b>.266**</b>
	$p$	.795	.113	.007	.013	.001
	$N$	161	161	161	161	161
5. Carry out experiments	$\rho$	.109	-.017	<b>.188*</b>	<b>.291**</b>	.110
	$p$	.165	.827	.016	.000	.161
	$N$	163	163	163	163	163
6. Analyze obtained results and draw conclusions.	$\rho$	.011	.027	<b>.257**</b>	<b>.198*</b>	<b>.196*</b>
	$p$	.890	.737	.001	.012	.013
	$N$	162	162	162	162	162

\* $p < .05$ . \*\* $p < .01$

Table 6 shows there are no statistically significant connections between factor 1 Importance of scientific and technical contents and the elements of implementing cognitive constructivist way of teaching scientific and technical contents. Neither are there statistically significant connections between factor 2 Need for scientific and technical education and the elements of implementing cognitive constructivist way of teaching scientific and technical contents.

Factor 3 competence for quality scientific and technical education is statistically significantly connected to all six elements. Teachers who rate higher their competences to teach Science and Technics, statistically significantly more often organize classes where pupils perceive phenomena and ask questions ( $p = .001$ ); collect information with research problem tasks ( $p = .000$ ); formulate assumptions (hypotheses) on possible answers to questions or solutions to problems ( $p = .001$ ); examine assumptions ( $p = .007$ );

carry out experiments/tests ( $p = .016$ ); analyze obtained results and draw conclusions ( $p = .001$ ). Factor 4 Professional enthusiasm is statistically significantly connected to four elements. Teachers who express a higher degree of enthusiasm, statistically significantly more often organize classes where pupils perceive phenomena and ask questions ( $p = .010$ ); examine assumptions ( $p = .013$ ); carry out experiments/tests ( $p = .000$ ); analyze obtained results and draw conclusions ( $p = .012$ ). Factor 5 Difficulty of teaching Science and Technics is statistically significantly connected to two elements. Teachers who rate higher the difficulty of teaching Science and Technics, statistically significantly more often organize classes where pupils examine assumptions ( $p = .001$ ); analyze obtained results and draw conclusions ( $p = .013$ ).

## Discussions

To achieve high-quality knowledge of pupils it is crucial to respect the didactic principle of learning activity. Cognitive constructivist teaching model is based on the assumption that pupils actively build the system of their own knowledge, with teachers having the role of providing adapted cognitive in emotional support. In our research, pupils' activities are covered in 6 elements of cognitive constructive model. We found out that out of the six elements of cognitive constructivist teaching model, teachers often organized activities where pupils perceive phenomena and ask questions (56.2%), collect information with research problem tasks (53.%) and carry out tests (47.9%). Activities where pupils formulate assumptions (hypotheses) on possible answers to questions or solutions to problems (47.9%); where pupils examine assumptions (58.6%) and where they analyze obtained results and draw conclusions (51.5) were carried out occasionally. It has to be pointed out that grade 2–I do rarely has a somewhat higher share in three items: pupils formulate assumptions (hypotheses) on possible answers to questions or solutions to problem (36.1%); pupils examine assumptions (20.7%), and pupils analyze obtained results and draw conclusions (24.3%).

The research showed that the elements of cognitive constructivist way of teaching scientific and technical contents were more often organized by teachers who rated higher their competence. The importance of competent teachers for quality implementation of their professional role is confirmed in numerous studies (Brophy and Good, 1986; Marzano, Pickering and Pollock, 2006; Hattie, 2009, 2018; Darling-Hammond and Richardson, 2009). Deriving from the obtained results, it is important that already during their studies students have opportunities to obtain insights into characteristics of cognitive constructivist way of teaching and develop skills of forming a cognitive conflict and of scaffolding as basic characteristics of cognitive constructivist model. The very elements of formulating hypotheses and their examination are the items for which a greater share of teachers claim their rare implementation. It is necessary to emphasize that cognitive conflict and providing scaffolding for pupils who have various capabilities, previous knowledge and motivation requires from teachers to observe the didactic principle of learning differentiation and individualization.

If students are to be trained in cognitive constructivist way of teaching scientific and technical contents, it is important that they themselves receive this way of teaching during their studies (Richardson, 1997; Valenčić Zuljan, 2007). In this context, didactic strategies of "open teaching" are important - such as problem-based approach, project work, research teaching. Numerous studies point out the importance of problem-based approach (Roth, 1995, as cited in McRobbie, Ginns and Stein, 2000; McCormick et al., 1996, as cited in McRobbie, Ginns and Stein, 2000) for heightening the awareness of technology and technology education. (Andersno & Walvoord, 1990, 1993, as cited in McRobbie, Ginns and Stein, 2000; Shapiro, 1996; Swain, 1991; Tyler, 1992). "The problem-solving access to educational content is always in the function of enabling students to experience, understand and evaluate the content that is being studied." (Mezak and Pejić Papak, 2019). Organization and teaching procedures should be chosen to maximize and sustain the student's thought activity and contribute to their conclusions and decision abilities.

McRobbie, Ginns and Stein (2000) carried out an investigation, using an interpretive research methodology, of preservice primary teachers' prior perceptions of design and technology and changes in their perceptions of design and technology as a result of their engagement in independent technology projects. In the research, there were 130 participants, enrolled in a one-year postgraduate teacher education program. Research findings confirmed the importance of including independent technology projects in courses for preservice primary teachers as a way of changing their perceptions of technology and technology education. Numerous studies (Anderson & Walvoord, 1990, 1993, as cited in McRobbie, Ginns and Stein, 2000; Shapiro, 1996; Swain, 1991; Tyler, 1992) confirm that engagement in independent investigations can stimulate changes in students' thinking and a broader understanding of technology.

What is crucial is the experiential learning of students future teachers through current open down-to-earth problems, as this contributes to a deeper personal understanding of learning contents and increased professional enthusiasm.

The research showed that teachers with a higher level of enthusiasm statistically significantly more often carried out elements of cognitive constructivist teaching model and more often organized classes where pupils perceive phenomena and ask questions; examine assumptions; carry out tests, and analyze obtained results and draw conclusions. The importance of teacher's enthusiasm has been confirmed in numerous studies (Rosenshine, 1970; Rosenshine and Furst, 1973; Brophy and Good, 1986; Patrick et al., 2003; Turner et al., 1998). Brophy and Good (1986) define "teacher enthusiasm" as one of the teacher qualities that significantly influences effective teaching. Rosenshine (1970), and Rosenshine and Furst (1973) established that teacher's enthusiasm and passion for the subject they teach correlate with pupils' achievements. Therefore it is important for students and teachers to be familiar with studies on the impact of teacher's enthusiasm, and also to research their own teaching in the perspective of the influence of enthusiasm on pupils. Lončarić and Pejić Papak (2009) emphasize the importance of teacher's research, which positively influences their professional commitment. Teachers' research is also an important factor of their professional development (Marentič Požarnik, 2018; Vogrinc and Valenčič Zuljan, 2009; Valenčič Zuljan, 2018).

The research showed no statistically significant differences between the frequency of implementing elements of cognitive constructivist way of teaching scientific and technical contents and factors Importance of scientific and technical contents and Need for scientific and technical education. We found out that teachers who rate higher the difficulty of teaching scientific and technical contents statistically significantly more often implement two of the six elements of cognitive constructivist model of teaching, namely they more often organize classes where pupils examine assumptions; analyze obtained results and draw conclusions.

Our research showed that the elements of cognitive constructivist way of teaching are more often organized by teachers with greater concern of their professional development, in our research measured with observance of new scientific research findings referring to learning, teaching and other subject matter as well as the reflection on their own pedagogic practice. In view of our study findings and the fact that professional development presents one of the basic competences of the modern teacher, it is important that already during their studies students future teachers are familiarized with the research on teacher's professional development and raised to awareness that taking care of their professional development is a basic value.

## Conclusions

The results of our study lead to the conclusion that all 6 elements of cognitive constructivist way of teaching should be strengthened, since grade 5 - (very often) does not have a high share in any element, which however would be expected given the importance of cognitive constructivist way of teaching scientific and technical contents. For quality teaching of natural and technical contents, the share of the following three items should particularly be strengthened: Pupils formulate assumptions (hypotheses) on possible answers to questions or solutions to problem; Pupils examine assumptions, and Pupils analyze obtained results and draw conclusions.

Data from our research lead to the conclusion that the frequency of implementing elements of cognitive constructivist teaching model is linked to the teachers' concern for their own professional development, since those who use new scientific research findings in their work and regularly reflect on their own pedagogical practice, statistically significantly more often organize elements (4 to 6) of cognitive constructivist way of teaching.

The research showed that the frequency of implementing elements of cognitive constructivist way of teaching is statistically significantly connected to 3 out of 5 factors: Competence for quality scientific and technical education (in all 6 elements); Professional enthusiasm (in 4 elements), and Difficulty of teaching Science and Technics (in 2 elements).

It would be sensible to continue research, which would additionally help shed light on the reasons for the findings of our study, among others class teachers' attitudes to the importance of cognitive constructivist way of teaching, what obstructs them in introducing this way of work, in which elements they would need additional support at the level of school or support in additional education at the system level, etc.

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### Conflict of interests

The authors declare no conflict of interest.

## References

- Abdulwahed, M., & Nagy, Z. K. (2009). Applying Kolb's experiential learning cycle for laboratory education. *Journal of engineering education*, 98(3), 283-294. <https://doi.org/10.1002/j.2168-9830.2009.tb01025.x>
- Akcay, H., & Yager, R. E. (2010). The impact of a science/technology/society teaching approach on student learning in five domains. *Journal of Science Education and Technology*, 19(6), 602-611. <https://doi.org/10.1007/s10956-010-9226-7>
- Anning, A. (1997). Drawing out ideas: Graphicacy and young children. *International Journal of Technology and Design Education*, 7(3), 219-239. <https://doi.org/10.1023/A:1008824921210>
- Avraamidou, L., & Osborne, J. (2009). The role of narrative in communicating science. *International Journal of Science Education*, 31, 1683-1707. <https://doi.org/10.1080/09500690802380695>
- Barron, B., & Darling-Hammond, L. (2013). Prospects and challenges for inquiry-based approaches to learning. In H. Dumont, D. Istance & F. Benavides (Eds.), *The nature of learning: Using research to inspire practice* (pp. 183-205). Ljubljana: Zavod Republike Slovenije za šolstvo.
- Blažič, M., Ivanuš Grmek, M., Kramar, M. & Strmčnik, F. (2003). *Didaktika* [Didactics]. Novo mesto: Visokošolsko središče.
- Boser, R. A., Palmer, J. D., & Daugherty, M. K. (1998). Students attitudes towards technology in selected technology education programs. *Journal of Technology Education*, 10(1), 4-19 <https://doi.org/10.21061/jte.v10i1.a.1>
- Brophy, J., & Good, T. L. (1986). Teacher behavior and student achievement. In M. Wittrock (Ed.), *Handbook of research on teaching* (pp. 340-370). New York: Macmillan Library.
- Cakici, Y., & Yavuz, G. (2010). The effect of constructivist science teaching on 4th Grade students' understanding of matter. *AsiaPacific Forum on Science Learning and Teaching*, 11(2), 1-8.
- Çalik, M., Ayas, A., Coll, R. K., Ünal, S., & Coştu, B. (2007). Investigating the effectiveness of a constructivist-based teaching model on student understanding of dissolution of gases in liquids. *Journal of Science Education and Technology*, 16(3), 257-270. <https://doi.org/10.1007/s10956-006-9040-4>
- Cotič, N., Plazar, J., Starčič, A. I., & Zuljan, D. (2020). The effect of outdoor lessons in natural sciences on students' knowledge, through tablets and experiential learning. *Journal of Baltic Science Education*, 19(5), 747. <https://doi.org/10.33255/jbse/20.19.747>
- Crompton, H. (2020). Contextualizing STEM Learning: Frameworks & Strategies. *Research on Outdoor STEM Education in the digital Age*, 13.
- Darling-Hammond, L., & Richardson, N. (2009). Research review/teacher learning: What matters. *Educational leadership*, 66(5), 46-53. Retrieved from <https://outlier.uchicago.edu/computerscience/OS4CS/landscapestudy/resources/Darling-Hammond-and-Richardson-2009.pdf>
- Dumont, H., & Istance, D. (2013). Analysing and designing learning environments for the 21st century. In H. Dumont, D., Istance & F. Benavides (Eds.), *The nature of learning: Using research to inspire practice* (pp. 19-34). Ljubljana: Zavod Republike Slovenije za šolstvo.
- Dzan, W. Y., Tsai, H. Y., Lou, S. J., & Shih, R. C. (2015). Satisfaction analysis of experiential learning-based popular science education. *International Journal of Distance Education Technologies (IJDET)*, 13(2), 93-109. <https://doi.org/10.4018/ijdet.2015040106>
- Fleer, M. (2000). Working technologically: Investigations into how young children design and make during technology education. *International Journal of Technology and Design Education*, 10(1), 43-59. <https://doi.org/10.1023/a:1008923410441>
- Fox-Turnbull, W., & Snape, P. (2011). Technology teacher education through a constructivist approach. *Design and Technology Education: An International Journal*, 16(2).
- Gardner, P. J., Penna, C., & Brass, K. (1996). 'Technology education in the post-compulsory years'. In P. J. Fensham (Ed.), *Science and Technology Education in the Post-Compulsory Years* (pp. 140-192). Australian Council of Educational Research, Melbourne.
- Gojkov, G. (2009). *Didaktika i metakognicija* [Didactics and metacognition]. Vršac: Visoka škola strukovnih studija za obrazovanje.
- Good, T. L., & Brophy, J. E. (2003). *Looking in classrooms* (9<sup>th</sup> ed.). Boston, MA: Allyn et Bacon.
- Hallström, J., Elvstrand, H., & Hellberg, K. (2015). Gender and technology in free play in Swedish early childhood education. *International Journal of Technology and Design Education*, 25(2), 137-149. <https://doi.org/10.1007/s10798-014-9274-z>
- Hattie, J. (2009). *Visible learning: a synthesis of over 800 meta-analyses relating to achievement*. London: Rutledge.
- Hattie, J. (2018). *Vidno učenje za učitelje: maksimiranje učinka na učenje* [Visual learning for teachers: maximizing the impact on learning]. Grīže: Svetovalno-izobraževalni center MI.
- Johnson, J. R. (1989). *Technology: report of the project 2061 phase 1 technology panel*. American Association for the Advancement of Science, Washington, DC.
- Jones, A. & Carr, M. (1992). Teachers' perceptions of technology education: Implications for curriculum innovation. *Research in Science Education*, 22, 230-239. <https://doi.org/10.1007/bf02356900>
- Kim, J. S. (2005). The effects of a constructivist teaching approach on student academic achievement, self-concept, and learning strategies. *Asia Pacific Education Review*, 6(1), 7-19. <https://doi.org/10.1007/bf03024963>
- Kolb, A. Y., & Kolb, D. A. (2009). Experiential learning theory: A dynamic, holistic approach to management learning, education

- and development. *The SAGE handbook of management learning, education and development*, 42, 68. <https://doi.org/10.4135/9780857021038.n3>
- Kolb, D. A. (1984). *Experiential learning*. Englewood Cliffs: Prentice-Hall.
- Lin, K. Y., Hsiao, H. S., Williams, P. J., & Chen, Y. H. (2020). Effects of 6E-oriented STEM practical activities in cultivating middle school students' attitudes toward technology and technological inquiry ability. *Research in Science & Technological Education*, 38(1), 1-18. <https://doi.org/10.1080/02635143.2018.1561432>
- Lončarić, D., & Pejić Papak, P. (2009). Profiliranje učiteljskih kompetencija [Profiling of teacher competencies]. *Odgojne znanosti*, 11(2), 479-497.
- Marentič Požarnik, B. (1987). *Nova pota v izobraževanju učiteljev* [A new path in teacher education]. Ljubljana: Državna založba Slovenije.
- Marentič Požarnik, B. (2004). *Konstruktivizem v šoli in izobraževanje učiteljev* [Constructivism in school and teacher education]. Ljubljana: Center za pedagoško izobraževanje Filozofske fakultete.
- Marentič Požarnik, B. (2018). *Psihologija učenja in pouka* [Psychology of learning and teaching]. Ljubljana: DZS.
- Marentič Požarnik, B., & Cencič, M. (2003). *Konstruktivizem v izobraževanju* [Constructivism in education]. *Pedagoška obzorja*, 18(2), 34-39.
- Marzano, R. J., Pickering, D. J., & Pollock, J. E. (2006). *Nastavne strategije: kako primijeniti devet najuspješnijih nastavnih strategija* [Teaching strategies: how to apply the nine most successful teaching strategies]. Zagreb: Educa.
- Mattes, W. (2007). *Nastavne metode: 75 kompaktnih pregleda za nastavnike i učenike* [Teaching methods: 75 compact reviews for teachers and students]. Zagreb: Naklada Ljevak.
- Mawson, B. (2007). Factors affecting learning in technology in the early years at school. *International Journal of Technology and Design Education*, 17(3), 253-269. <https://doi.org/10.1007/s10798-006-9001-5>
- Mawson, B. (2010). Children's developing understanding of technology. *International Journal of Technology and Design Education*, 20(1), 1-13. <https://doi.org/10.1007/s10798-008-9062-8>
- Mawson, W. B. (2013). Emergent technological literacy: what do children bring to school?. *International Journal of Technology and Design Education*, 23(2), 443-453. <https://doi.org/10.1007/s10798-011-9188-y>
- Moustafa, A., Ben-Zvi-Assaraf, O., & Eshach, H. (2013). Do junior high school students perceive their learning environment as constructivist?. *Journal of Science Education and Technology*, 22(4), 418-431. <https://doi.org/10.1007/s10956-012-9403-y>
- McRobbie, C. J., Ginns, I. S., & Stein, S. J. (2000). Preservice primary teachers' thinking about technology and technology education. *International Journal of Technology and Design Education*, 10(1), 81-101. <https://doi.org/10.1023/A:1008941520152>
- Mezak, J., & Papak, P. P. (2019, May). Problem based learning for primary school junior grade students using digital tools. In 2019 42<sup>nd</sup> International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO) (pp. 697-702). IEEE. <https://doi.org/10.23919/MIPRO.2019.8756775>
- Miao, Z., Reynolds, D., Harris, A., & Jones, M. (2015). Comparing performance: a cross-national investigation into the teaching of mathematics in primary classrooms in England and China. *Asia Pacific Journal of Education*, 35(3), 392-403. <https://doi.org/10.1080/02188791.2015.1056593>
- Mihaliček, S. (2011). Zadovoljstvo i sreća učitelja [Teacher satisfaction and happiness]. *Napredak: Časopis za interdisciplinarna istraživanja u odgoju i obrazovanju*, 152(3-4), 389-402. Retrieved from <https://hrcak.srce.hr/82782>
- Muijs, D., & Reynolds, D. (2002). Teachers' beliefs and behaviors: What really matters? *The Journal of Classroom Interaction*, 37(2), 3-15.
- Muijs, D., & Reynolds, D. (2017). *Effective teaching: Evidence and practice*. Sage. Retrieved from <https://1filedownload.com/wp-content/uploads/2019/12/04O-Effective-Teaching-Evidence-And-Practice.pdf>
- Orbanić Dolenc, N., Dimec, D. S., & Cencič, M. (2016). The effectiveness of a constructivist teaching model on student's understanding of photosynthesis. *Journal of Baltic science education*, 15(5). Retrieved from [https://sisu.ut.ee/sites/default/files/opikasitus/files/orbanic\\_dimec\\_cencic\\_2016\\_the\\_effectiveness\\_of\\_a\\_constructivist\\_teaching\\_model\\_on\\_students\\_understanding\\_of\\_photosynthesis.pdf](https://sisu.ut.ee/sites/default/files/opikasitus/files/orbanic_dimec_cencic_2016_the_effectiveness_of_a_constructivist_teaching_model_on_students_understanding_of_photosynthesis.pdf)
- Palincsar, A. S. (1998). Social constructivist perspectives on teaching and learning. *Annual review of psychology*, 49(1), 345-375. Retrieved from <https://www.annualreviews.org/doi/abs/10.1146/annurev.psych.49.1.345>
- Parker, V., & Gerber, B. (2000). Effects of a science intervention program on middle-grade student achievement and attitudes. *School Science and Mathematics*, 100(5), 236-242. <https://doi.org/10.1111/j.1949-8594.2000.tb17263.x>
- Parker-Rees, R. (1997). *Learning from play: Design and technology, imagination and playful thinking*. IDATER 1997 conference (pp. 20-25). Loughborough: Loughborough University.
- Patrick, H., Turner, J. C., Meyer, D. K., & Midgley, C. (2003). How teachers establish psychological environments during the first days of school: Associations with avoidance in mathematics. *Teachers College Record*, 105(8), 1521-1558. Retrieved from <https://users.ugent.be/~wbeyers/scripts/2016/artikels/Patrick%20%20Turner%202003.pdf>
- Pečar, M. (2018). *Izkušnje in stališča učiteljev o prilagajanju pouka predznanju in interesom učencev: doktorska disertacija* [Teachers' experiences and attitudes towards adapting lessons to students' prior knowledge and interests: doctoral dissertation] [Doctoral dissertation], Univerza v Ljubljani, Pedagoška fakulteta.
- Plešec, G. R. & Zuljan, M. V. (2019). Učne oblike v osnovni šoli in obrnjeno učenje in poučevanje [Learning forms in primary school and reverse learning and teaching]. *Journal of Elementary Education*, 12(3), 267-290. <https://doi.org/10.18690/rei.12.3.267-290.2019>
- Phillips, D. C. (1995). The good, the bad, and the ugly: The many faces of constructivism. *Educational Researcher*, 24(7), 5-12. <https://doi.org/10.3102/0013189X024007005>
- Reynolds D., & Farrell, S. (1996). *Worlds Apart? A Review of International Studies of Educational Achievement Involving England*. London: HMSO.
- Richardson, V. (Ed.). (1997). *Constructivist teacher education: Building new understandings*. Psychology Press.
- Ritchie, S. M., Tomas, L., & Tones, M. (2011). Writing stories to enhance scientific literacy. *International Journal of Science Education*, 33(5), 685-707. <https://doi.org/10.1080/09500691003728039>
- Rosenshine, B. (1970). Enthusiastic teaching: A research review. *The School Review*, 78(4), 499-514. Retrieved from <https://>

- [www.journals.uchicago.edu/doi/abs/10.1086/442929?journalCode=schoolreview](http://www.journals.uchicago.edu/doi/abs/10.1086/442929?journalCode=schoolreview)
- Rosenshine, B. (1979). Content, time, and direct instruction. Research on teaching: Concepts, findings, and implications. In P. Peterson & H. Walberg (Eds.), *Research on teaching: Concepts, findings and implications* (pp. 28-56). Berkeley, CA: McCutchan.
- Rosenshine, B., & Furst, N. (1973). The use of direct observation to study teaching. In R. Travers (Ed.), *Second handbook of research on teaching* (pp.122-183). Chicago: Rand McNally.
- Shapiro, B. L. (1996). A case study of change in elementary student teacher thinking during an independent investigation in science: Learning about the "face of science that does not yet know". *Science Education*, 80(5), 535-560. [https://doi.org/10.1002/\(SICI\)1098-237X\(199609\)80:5<535::AID-SCE3>3.0.CO;2-C](https://doi.org/10.1002/(SICI)1098-237X(199609)80:5<535::AID-SCE3>3.0.CO;2-C)
- Sparks-Langer, G. M., Pasch, M., Starko, A. J., Moody, C. D. & Gardner, T. G. (2000). *Teaching as decision making: successful practices for the secondary teacher*. Merrill Prentice Hall.
- Stables, K. (1997). Critical issues to consider when introducing technology education into the curriculum of young learners. *Journal of Technology Education*, 8(2). <https://doi.org/10.21061/jte.v8i2.a.4>
- Šteh Kure, B. (1999). Poimovanja učenja, poučavanja in znanja v povezavi z učnim procesom in uspehom [Concepts of learning, teaching and knowledge in relation to the learning process and success]. *Sodobna pedagogika*, 50(1), 250-265.
- Strmčnik, F. (2001). *Didaktika: osrednje teoretične teme* [Didactics: central theoretical topics]. Ljubljana: Znanstveni inštitut Filozofske fakultete.
- Swain, J. R. L. (1991). The nature and assessment of scientific explorations in the classroom. *School Science Review*, 72(260), 65-77.
- Tigchelaar, A., Brouwer, N., & Vermunt, J. D. (2010). Tailor-made: Towards a pedagogy for educating second-career teachers. *Educational Research Review*, 5(2), 164-183. <https://doi.org/10.1016/j.edurev.2009.11.002>
- Turja, L., Endepohls-Ulpe, M., & Chatoney, M. (2009). A conceptual framework for developing the curriculum and delivery of technology education in early childhood. *International Journal of Technology and Design Education*, 19(4), 353-365. <https://doi.org/10.1007/s10798-009-9093-9>
- Turner, J. C., Meyer, D. K., Cox, K. E., Logan, C., DiCintio, M., & Thomas, C. T. (1998). Creating contexts for involvement in mathematics. *Journal of Educational Psychology*, 90(4), 730-745. <https://doi.org/10.1037/0022-0663.90.4.730>
- Twyford, J., & Järvinen, E. M. (2000). The formation of children's technological concepts: A study of what it means to do technology from a child's perspective. *Journal of Technology Education*, 12(1), 32-48. Retrieved from <https://techworks.lib.vt.edu/bitstream/handle/10919/8248/twyford.pdf?sequence=1>
- Tyler, R. (1992). Independent research projects in school science: Case studies of autonomous behavior. *International Journal of Science Education*, 14, 393-411.
- Valenčić Zuljan, M. (2016). Pupil's assessment of teaching and of him/herself as learner-relevant items in the teacher's creation of effective learning environment. *Croatian Journal of Education: Hrvatski časopis za odgoj i obrazovanje*, 18(Sp. Ed. 1), 213-230. <https://doi.org/10.15516/cje.v18i0.2219>
- Valenčić Zuljan M., & Kalin J. (2020). *Učne metode in razvoj učiteljeve metodične kompetence* [Teaching methods and development of teacher methodological competence]. Ljubljana: Pedagoška fakulteta.
- Valenčić Zuljan, M. (2002). Kognitivno-konstruktivistični model pouka in nadarjeni učenci [Cognitive-constructivist model of teaching and gifted students]. *Pedagoška obzorja*, 17(3-4), 3-12.
- Valenčić Zuljan, M. (2007). Students' conceptions of knowledge, the role of the teacher and learner as important factors in a didactic school reform. *Educational Studies*, 33(1), 29-40. <https://doi.org/10.1080/03055690600948166>
- Valenčić Zuljan, M. (2018). Factors of teachers' professional development. In N. Tatković, F. Šuran & M. Diković (Eds.), *Reaching horizons in contemporary education* (pp. 9-31). Pula: Juraj Dobrila University of Pula, Faculty of Educational Sciences.
- van der Lans, R. M., van de Grift, W. J., & van Veen, K. (2017). Individual differences in teacher development: an exploration of the applicability of a stage model to assess individual teachers. *Learning and Individual Differences*, 58, 46-55. <https://doi.org/10.1016/j.lindif.2017.07.007>
- Vogrinc, J., & Zuljan, M. V. (2009). Action research in schools—an important factor in teachers' professional development. *Educational studies*, 35(1), 53-63. <https://doi.org/10.1080/03055690802470399>
- Vosniadou, S., Ioannides, C., Dimitrakopoulou, A., & Papademetriou, E. (2001). Designing learning environments to promote conceptual change in science. *Learning and instruction*, 11(4-5), 381-419. [https://doi.org/10.1016/S0959-4752\(00\)00038-4](https://doi.org/10.1016/S0959-4752(00)00038-4)
- Vujičić, L., Pejić Papak, P., & Valenčić-Zuljan, M. (2020). *Okruženje za učenje i kultura ustanove* [Learning environment and culture institutions], Rijeka: Sveučilište u Rijeci, Učiteljski fakultet.
- Wilen, W., Hutchison, J., & Ishler, M. (2008). *Dynamics of effective secondary teaching*. Boston: Pearson.
- Wolters, F. D. K. (1989). A PATT study among 10 to 12-year old students in the Netherlands. *Journal of Technology Education*, 1(1). Retrieved from <https://techworks.lib.vt.edu/bitstream/handle/10919/8403/falco.pdf?sequence=1>
- Yager, R. E. (1991). The constructivist learning model: towards real reform in science education. *The Science Teacher*, 58(6), 52-57.

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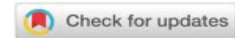
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# Peculiarities of The Students' Conceptual Structures and Basic Beliefs Correlation

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**Abstract:** The research is basically aimed at studying the students' conceptual structure and basic beliefs being formed and correlated as well as at their classifying in accordance with the level of integration and coherence. The students' conceptual structures and basic beliefs are analyzed in the article; special attention is paid to semantic, categoric and conceptual abilities coherence (homogeneity) and formedness. If speaking about methodology of the research, it includes theoretical and empirical methods. Theoretical, cluster and factor analyses as well as the Kruskal-Wallis rank sum test allowed us to define 5 clusters (groups) with low, medium-low, mean (average), high and extraordinary indices of the students' conceptual structure and basic beliefs formedness. These clusters significantly differ at levels from  $p \leq 0.01$  to  $p \leq 0.05$ . The students' conceptual structure and basic beliefs correlations form the level systems classification characterized by different coherence of these levels. It is sufficient to conclude that different basic beliefs are the core of the students' subjective inner world and are correlated with these beliefs conceptual structures specificity. The attained results prove the phenomenon of the intellectual resource "splitting": the intellectual resource can split into productive and non-productive components in case of high-level intelligence, i.e. if the intelligence level is too high the intellectual resource and its basic components can be insufficiently formed and/or poorly developed.

*Keywords:* Conceptual structures, basic beliefs, correlations classification.

## Introduction

Since the notion "basic beliefs" was defined by S. Epstein in his cognitive-experimental theory and by R. Janoff-Bulman's personal basic beliefs cognitive concept, lots of researchers use it as the basic variable to explain the features of a person's surrounding world events perception and to define persons behavior peculiarities. The way the persons interpret the events that take place in their lives (i.e. mentioning the ability to gain new experience, paying attention to any possibility for personal development or just perceiving them as unfair or an obstacle) has a great influence on their well-being, success and being satisfied with their life or not. This aspect is particularly relevant for young people who are in their early stages of adulthood. At the same time those young people who perceive the world as absolutely unfair and the relations with others – hostile or adversarial, have a low self-esteem and value their opportunities at a low level are of a great need in psychological support because in conditions of personal formation these people can be on the outside of an active and successful interaction with the world, with themselves and others. On the other hand, people with the well-developed sense of purpose and positive basic beliefs are of great importance for society; they help the society to be in progress. That is why psychological and pedagogical support of the young people having negative basic beliefs is one of the most important and modern trends in psychological work. But this help implementation requires understanding the mechanisms and predictors of basic beliefs forming. These predictors can include cognitive resource (aimed at processing information, i.e. defining the character of a human's personal perception of the surrounding world). Thus, the research is aimed at studying the connection of conceptual structures (as the basic part of the cognitive resource) and basic beliefs of the young people (students).

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It has already been mentioned that basic beliefs are the person's hierarchically organized cognitive and emotional implicit opinions, judgments and knowledge, which help the person to perceive the events of the surrounding world (Kibal'chenko and Eksakusto, 2020; Padun and Kotel'nikova, 2008). Most of the researches carried out and connected with the basic beliefs and their impact on perceiving the events of person's life let us make the following conclusions.

First of all, persons' basic beliefs are connected with the PTSD symptoms severity condition, with the quantity and types of traumatic events as well as with the ability of post traumatic growth. The maximum effect while working with victims is observed on the level of basic beliefs about the surrounding world functioning (Bulman and Timko, 2020). Those people who had any traumatic event (e.g. physical/somatic disease, active service/commitment, lost their relatives, loss of their motherhood and/or home (refugees)) in their lives are characterized by such basic beliefs as "Benevolence of the World", "Benevolence of People" and "Luck" being negatively expressed (Ter Heide, Sleijpen and van der Aa, 2017; Dekel at all., 2004; Ward and Plagnol, 2019). It is found out that a long period of the existential stress impact bringing person to depression is accompanied by negative attitude to benevolence of the world, being sure that the world is unjust and uncontrolled as well as by the low self-esteem and poor belief in commitment to succeed (Zaluski, 2015; Padun and Kotel'nikova, 2012). The basic beliefs are proved to be the so called "mediator" between traumatic event and dissociation and the strongest connection of these problems is found with the beliefs of the world benevolence and self-esteem (Lilly, 2011). The research made by Goldenberg, I., Matheson, K. shows that posttraumatic stress symptoms are poorly expressed in a group of those people who had any traumatic event in their lives but still have positive basic beliefs of the world; these people are likely to use active and constructive strategies in challenges overcome and problems solving (Goldenberg and Matheson, 2005). Some people having traumatic events (splitting personal basic beliefs of themselves, world and others) are as well characterized by the effect or posttraumatic growth: they are able to reconsider their basic beliefs after the traumatic event, i.e. the integrative system of beliefs can be reconstructed (Mazor, Gelkopf and Roe, 2020; Lahav, Bellin and Solomon, 2016).

Secondly, basic beliefs are the basis of the human's subjective well-being, allowing human to be stable (robust), satisfied and successful in different spheres of life and happy while interacting with others. Some researches reflect the idea of people having stable positive basic beliefs of the benevolence of the world, being characterized by the higher level of well-being in general and in separate spheres of their lives (health, social relations, educational activity, etc.) (Dzuka and Dalbert, 2006; Belyaeva, Kyoppel' and 2018; Shelegina, 2018; Tsvetkov, 2020; Lifshits, 2019; Elshanskij, 2020). On the other hand, external negative influence (bullying, mobbing) can destroy positive basic beliefs of self-esteem, other people (and relations with them) estimation, benevolence of the world and bring person to subjective ill-being and stress reactions (Mikkelsen, 2001). It is also found out that basic beliefs of the benevolence of the world and its controllability can sufficiently define the processes of adaptation and challenges overcome. Taking physically challenged people as an example, it was proved that the basic beliefs destruction can lead to longer period of rehabilitation and adaptation (Monden et al., 2016). Herewith, being stable (robust) and having positive basic beliefs, in case of any traumatic event, people continue having positive emotions towards the world around and have just insufficient functional disturbance (Bonanno, 2004).

Modern researches show that the basic beliefs (hope, belief in a just and controlled world and events, etc.) determine the aim of life and being satisfied with it; and if the levels of these factors grow up the level of stress and anxiety caused by Covid-19 grows down. Trzebiński, J., Cabański, M., Czarnecka, J. Z. suppose that basic beliefs can be called "buffer" redeeming from anxiety, unproductive thinking and making decisions in case of an unpredictable threat (Trzebiński, Cabański and Czarnecka, 2020).

Taking into account the importance of basic beliefs for a person's world and various events perception, separate and few studies are also aimed at finding the predictor of developing such faiths as belief in a just world, in a value of human selfhood, in controllability of the world. These studies suggest that these predictors include conceptual thinking and conceptual structures forming the basis of a person's intellectual resource.

Nowadays the problem of conceptual thinking and conceptual structures of personality is the most popular topic in psychological and interdisciplinary research for scientists and researchers around the world. Theoretical analysis of this problem studying basic approaches helps to make a suggestion that the most promising one is to study conceptual thinking and its structural features as a form of an individual intelligence integral work as a whole; the information processing elaboration as well as regulation and motivation are considered being core components of intellectual activity (Pulyaeva and Nevryuev, 2020; Gavrilova and Leshcheva, 2013; Volkova and Gusev, 2016; Maksimović and Osmanović, 2019). The conceptual abilities forming conceptual structures play a leading role among different types of cognitive abilities and are represented in three forms: semantic abilities (digestion, storage and updating of the verbal signs content); categoric (categorical signs, characterized by different

generality degrees, separating and operating) and conceptual abilities (new mental contents generating).

This research studies conceptual abilities as the most important ones among all conceptual structures. Theoretical analysis showed that person's conceptual abilities are manifested in categorization, explanation, interpretation, in a predominant cognitive style and reflect the features of a person's cognitive assessment of the world around him/her (events, situations, etc.) (Quillien, 2020). Understanding and analyzing the events and transformations taking place is determined by the level of conceptual abilities development and leads to an understanding of correlations being the bases of these transformations/changes (McCaslin and Kilrea, 2019).

For example, the study held by L. Shi and co-authors showed that the higher the mental capacity, adaptability and flexibility of a human and his/her informational connections are, the higher his/her well-being is (Shi, et al., 2018). It was also found that cognitive assessments of an upcoming event (their favorability in terms of self-efficacy, control and, optimism) have an impact on coping with the situation (distress, being satisfied with decision-making) (Major et al., 1998).

It should be emphasized that conceptual abilities are the key ones among intellectual abilities; they are the mental qualities making conditions for new (absent in actual circumstances or in absorbed basic knowledge) mental contents generating. The following criteria are identified as conceptual abilities: identification of implicit signs and connections; creating new beliefs and ideas; constructing a variable number of the situation versions, etc. (Holodnaya and Hazova, 2017). Conceptualization brings about managing own personal resources and "creating" new ones (Hazova, 2016).

The fact of the conceptual structures (and, in particular, conceptual abilities) being connected and correlated with basic beliefs (being a part of the personality worldview) is confirmed by separate studies conducted in the context of the psychology of intelligence and the intellectual resource of personality (Holodnaya, 2019; Hazova, 2018; Trifonova, 2016; Artemova and Lezhnina, 2016). The authors found out that the degree of conceptual abilities development and basic beliefs character determine the overall success of person (Kibal'chenko, Eksakusto and Istratova, 2017). We have also identified "harmonious" models of the basic beliefs productive aspects intellectual predictors. For example, the self-control (SC) predictors system includes: directly related styles "Reflexivity", "Abstract conceptualization", "Field independence" and the inversely related style "Rigidity". All styles of this system, taking into account the inverse relation with "Rigidity", create a harmonious unit for the degree of self-control assessing (Kibal'chenko and Eksakusto, 2020).

The research carried out by S. Jeavons, K.M. Greenwood points out the connection of basic assumptions and cognitive appraisal; at the same time factor structures of strategy, attributions and cognitive assessment were incomplete and unstable that demands additional check of results (Jeavons and Greenwood, 2007). Correlation of the intellectual and personal resources represented by basic beliefs shows that the higher intelligence indices are, the lower the faith in controllable world is, as well as the average intelligence level determines belief of benevolence of the world and a high self-worth index (Budakova and Matsuta, 2016).

The relations between conceptual abilities and basic beliefs form a dyad of the foundations of a person's value-sense and conceptual view of oneself, other people and the world as a whole; this dyad depends on coherence (homogeneity) of conceptual abilities and basic beliefs indices being well/poorly formed (Kibal'chenko, Istratova and Eksakusto, 2019). The study of this connection is of great importance in terms of its manifestation peculiarity among young people (students) being a special group characterized by different level of intellectual and personal resources integration; this difference depends on age (integrating ideal and real during mental activity) and social (low vital capacity, contradictory basic beliefs) features.

In our opinion, the results of the analysis and the assumptions put forward provide an empirical study of the conceptual structures and basic beliefs correlations. It is therefore important to define connection between conceptual structures and basic beliefs empirically. Hypothetically, the relations between conceptual structures and basic beliefs form systems with different coherence (homogeneity) and have their own features. These differences depend on the fact that different basic beliefs, being the core of the human subjective world, are connected with the special nature of individual conceptual structures.

## Materials and Methods

The following methods and techniques were used to define the conceptual abilities and basic beliefs indices:

1. Conceptual categoric abilities assessment: "Three words meaning generalization" (Holodnaya et al., 2019).
2. Semantic and conceptual abilities assessment: "Problem statement", "Pictorial and verbal interpretation", "Concept cognitive content" (Holodnaya, 2019). "Resource" is used as a key cue word.

3. The following methods were used for each ability unit: "Words free sorting test" (Kolga); "Conceptual synthesis" (Holodnaya et al., 2019; Holodnaya, 2019).

4. World assumptions scale (WAS) (R. Janoff-Bulman) was used to study such indices as "Benevolence of the World", "Meaningfulness of the World" and "Self-Worth".

5. The methods of the results processing and interpreting are as follows: hierarchical cluster analysis with more than two variables was used to define coherent (homogeneous) groups; statistic criteria (Kruskal-Wallis one-way analysis of variance) and Cluster method were used to define within-groups linkage and factor analysis in SPSS (IBM SPSS Statistics Subscription Trial for Mac OS).

One hundred and thirty-four Southern Federal University students (76 males and 58 females) took part in the research. Average age of the respondents was 20.5 years (19-22 years old). 55.7 per cent male and 44.3 per cent female students.

## Results

According to the purpose of the research and the hypotheses formulated, the diagnostic results were used for hierarchic cluster analysis at the first stage of the study; the analyses included the following students' data: indices of the conceptual thinking and basic beliefs formedness level; conceptual synthesis; the concept generality degree; ability to identify variety of concepts content private and common features; ability to match concepts to categoric and class-descriptive commonalities; the students' basic beliefs level indices.

Independent clusters – homogeneous (coherent, congeneric) groups, shown in fig.1, were defined during the process of clustering.

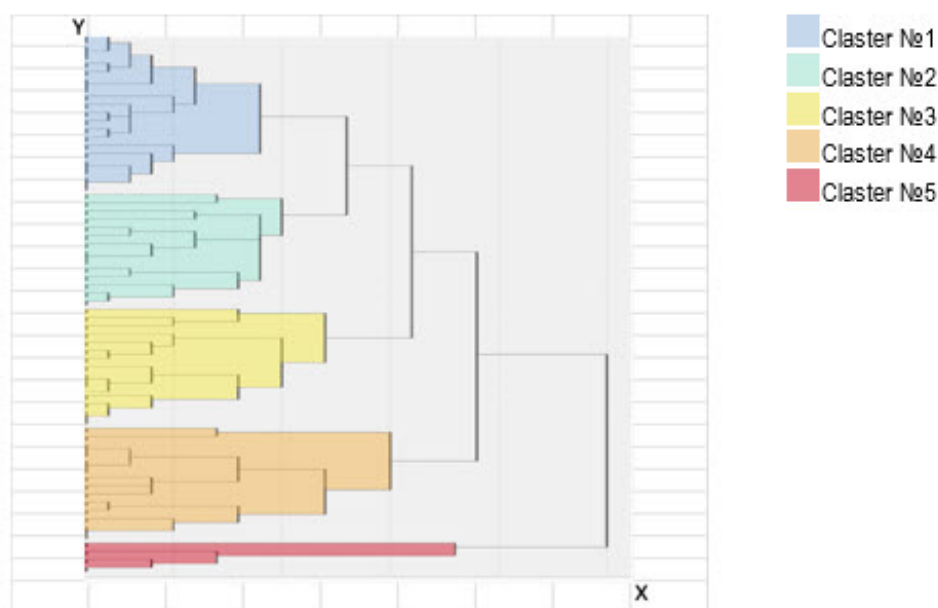


Figure 1. Tree diagram of the analysis results clustering

Each cluster is a group including results of students with maximally related conceptual structures and basic beliefs formedness levels. The first cluster includes 29.3 per cent of students; the mean observation is 2.32 points in conceptual structures formedness and 2.21 points in basic beliefs formedness level.

The second cluster includes 16.7 per cent of students with the following mean values: 3.2 points in conceptual structures and 2.9 – in basic beliefs formedness level.

The third one is represented by 31.4 per cent of students, characterized by 3.4 points in conceptual structures formedness level and 3.31 – in basic beliefs formedness level.

The fourth cluster includes 16.4 per cent of students with 4.4 and 4.39 points in conceptual structures and basic beliefs formedness level.

The fifth cluster is thin on the ground (6.3 per cent of students), but significantly differs from all previous ones in conceptual structures and basic beliefs formedness level. The mean value here is 6.00 and 5.02 points respectively.

Thus, five results "casts" were defined taking into account clusters quantitative content; this fact

helped us to identify five homogeneous groups of students and to study peculiarities of the conceptual structures and basic beliefs correlation.

All the students were split up into five sampling groups in accordance with the defined clusters; these sampling groups differ in a level of students' conceptual structures and basic beliefs formedness:

- group characterized by low level of conceptual structures and basic beliefs formedness (cluster No. 1);
- group with medium-low indices (cluster No. 2);
- group with medium (average) indices (cluster No. 3);
- group characterized by high indices (cluster No.4);
- and a group with extraordinary indices of conceptual structures and basic beliefs formedness level (cluster No. 5).

The students are symmetrically grouped into clusters in accordance with the formedness levels, but their quantity in these groups is asymmetrical.

The statistic processing of the results was held on the second step of the research; the Kruskal-Wallis one-way analysis of variance was used to analyze five groups (clusters) according to the following indices: categoric generalization; conceptual synthesis; involuntary categorization; cognitive content of the "resource" concept; pictorial and verbal interpretation of the "resource" concept; the "resource" concept problem statement and the students' basic beliefs formedness level indices.

The groups do not differ in three variables of the eleven ones, i.e. equality of these groups is 27.2 per cent, but in 72.8 per cent these groups (clusters) of students significantly differ. Three variables connecting the clusters are as follows:

- associative categorization, i.e., awareness of the categories meanings, ability to use variety of concepts (categoric generalization - CG). This fact proves that all the students participating in the research are characterized by a very similar level of the categories meaning awareness;
- the degree of semantic context complexity (conceptual synthesis – CS), i.e. general idea of the described "resource" concept;
- the level of the conceptual experience formedness in a structure of the students conceptual thinking (problem statement – PS), i.e., the abilities to tease out the variety of private and general features and to match concepts to categoric and class-descriptive commonalities do not differ significantly.

Statistically significant differences are teased out in accordance to the following characteristics:

- involuntary categorization – IC (the levels of involuntary intellectual control) (hemp. = 13.76,  $p \leq 0,01$ ). The better the conceptual structures and basic beliefs are formed, the higher the level of involuntary categorization is;
- the levels of the "resource" concept cognitive content (CC) formedness (hemp. = 23.92,  $p \leq 0,01$ ) as a stimulus reflecting the students' personal success. This data show that the students of different groups defined during the research are characterized by different levels of awareness of personal success concepts; by different understanding and using the gained experience for each concept. The better the conceptual structures and basic beliefs are formed the higher the level of the students' awareness of personal success concepts and their ability to use their experience are;
- integral conceptual structures including the pictorial and verbal interpreting (PVI) of the "resource" concept (hemp. = 7.41,  $p \leq 0,05$ ), i.e., the students' ability to express personal experience through mental images of this concept is formed differently. The better the conceptual structures and basic beliefs are formed the higher the level of ability to express personal experience through mental images of the concept is;
- general index of the conceptual thinking (CT) (hemp. = 57.08,  $p \leq 0,01$ ).

Five groups were analyzed diagnostically and in accordance with basic beliefs major characteristics; the results of this analysis defined significant differences in the following indices:

- general attitude to the "benevolence of the world", "just of the world" and "benevolence of people" (BW) (hemp. = 21.89,  $p \leq 0,01$ );
- general attitude to world understanding, events controllability, being just and occasional (WU) (hemp. = 22.55,  $p \leq 0,01$ );
- beliefs of self-worth, self-control and ability to control and to rule the events (SW) (hemp. = 22.77,  $p \leq 0,01$ );
- basic beliefs formedness mean value (BB) (hemp. . = 53.53,  $p \leq 0,01$ ).

These differences show that the students included in the groups defined by cluster analysis are characterized by dissimilarities in "subjective core of personality", general view of the world, development characteristics harmony and balance and basic beliefs formedness.

The results of the statistic analysis prove our suppositions:

- the students' semantic, categoric and conceptual abilities coherence with their basic beliefs differs in levels;
- the students whose basic beliefs are well-formed (vs. the students whose basic beliefs are not formed or poorly-formed) are characterized by high level of conceptual structures formedness.

The differences defined at the second stage of the research helped us to carry the third step and to study the peculiarities of the conceptual structures and basic beliefs correlation in each group (cluster).

The "resource" stimulus was studied at the stage of factor analysis as a general ability of a person preconditioning success. This fact helped to lower the number of variables and to define coherence (homogeneity) of the students' conceptual abilities and basic beliefs formedness indices.

Factorization of the first group of students (with low level of conceptual structures and basic beliefs formedness) defined as a cluster No. 1 is as follows: the summary dispersion as a result of factor analysis is 68.7 per cent. A full three-component factor structure resulted from rotation (varimax with Kaiser Normalization); this structure is characterized by direct correlation prevailing, but also includes two indices with inverse correlation (Table 1).

**Table 1**

*Factor structure of the students' semantic, categoric and conceptual abilities indices coherence with their basic beliefs ones (group 1 - with low results)*

Characteristics	Components in group 1		
	F1	F2	F3
CG	<b>0,79</b>	-0,29	-0,04
CS	0,44	<b>0,51</b>	-0,40
IC	0,58	0,23	<b>-0,63</b>
CC	0,25	<b>-0,65</b>	0,08
PS	0,00	0,39	<b>0,70</b>
PVI	0,25	<b>0,68</b>	0,23
BW	<b>0,82</b>	-0,15	0,26
WU	<b>0,92</b>	0,07	0,14
SF	<b>0,83</b>	-0,10	0,19
Percentage load	34,7	50,2	68,7

F1 is maximally loaded, crystallizing. It includes directly correlated indices of such variables as categoric generalization and basic beliefs general direction indices (i.e. belief in benevolence of the world, benevolence of people, the good prevailing over the evil, events controllability and just, belief in ability to control the events).

F2 includes direct variables (conceptual synthesis, "resource" mental representation) and inverse index of this concept awareness. This distribution proves disharmonic, discordant correlation between conceptual structures and mental abilities of these students; i.e. the "resource" concept pattern is formed, but these students' awareness of this concept field content is poorly-developed because they have lack of necessary experience in using the "resource" concept content.

F3 includes the directly and inversely correlated indices of the "resource" concept experience and the form of involuntary intellectual control. Thus, the students of this group are characterized by indices narrow equivalence range (analyticity) if they have a potential in problem statement. This fact indicates

lower rates of involuntary and associative memorizing; as well as the ability to operate better with accurate rather than abstract conceptual structures.

The students of the second cluster (group 2) characterized by medium-low conceptual structures and basic beliefs formedness indices showed the following results: the summary dispersion as a result of factor analysis is 76.5 per cent; this is a fact of integrity of the results.

The four-component full factor structure (Table 2) resulted from the analysis; the character of correlations is mixed (direct and inverse ones). The first three factors are of great interest and the fourth one is unstable.

**Table 2**

*Factor structure of the students' semantic, categoric and conceptual abilities indices coherence with their basic beliefs ones (group 2 - with medium-low results)*

Characteristics	Components			
	F1	F2	F3	F4
CG	-0,02	<b>0,62</b>	-0,01	0,48
CS	-0,14	<b>0,87</b>	0,16	-0,04
IC	0,39	<b>0,80</b>	-0,10	0,05
CC	0,37	-0,16	<b>-0,76</b>	0,03
PS	<b>-0,86</b>	-0,08	0,12	0,26
PVI	-0,28	0,15	0,11	<b>0,79</b>
BW	0,24	-0,07	<b>0,87</b>	0,06
WU	<b>0,54</b>	-0,18	-0,30	0,53
SF	<b>0,91</b>	0,08	0,13	-0,04
Percentage load	25,5	46,4	63,1	76,5

F1 includes characteristics of conceptual abilities ("resource" problem statement) inversely correlated with basic beliefs (meaningfulness of the world and self-worth) characteristics. This factor reflects the gaps of the students' individual intellectual and personal resource integration.

F2 includes semantic, categoric and conceptual abilities (such as categoric generalization, conceptual synthesis and involuntary categorization) formedness indices. Thus, the conceptual structures are differentiated in a structure of intellectual and personal resource; this fact correlates with the 1st factor gaps.

F3 shows an inversely directed correlation between the belief of the benevolence of the world and the "resource" concept cognitive content. The contradictory correlation between the belief in the benevolence of the world and awareness of personal current and potential opportunities leads to the conclusion that there are some gaps in adaptive potential of the students included into this group. Moreover, they are unable to manage their intellectual and personal resource and the events constantly.

F4 contains only one variable and is unstable.

If speaking about the students included into the 3rd group (with mean (average) indices of the conceptual structures and basic beliefs formedness) and factorization of the analysis results, we can say that the summary dispersion here is 71.0 per cent. The three-component full factor structure, characterized by direct connection, resulted from rotation (Table 3).

**Table 3**

*Factor structure of the students' semantic, categoric and conceptual abilities indices coherence with their basic beliefs ones (group 3 - with mean (average) results)*

Characteristics	Components		
	F1	F2	F3
CG	<b>0,86</b>	0,00	-0,21
CS	0,06	-0,10	<b>0,80</b>
IC	<b>0,70</b>	-0,29	0,12
CC	0,16	0,10	<b>0,82</b>
PS	-0,15	<b>0,84</b>	0,07
PVI	0,16	<b>0,78</b>	-0,04
BW	<b>0,74</b>	0,26	0,44
WU	<b>0,73</b>	0,14	0,39
SF	<b>0,68</b>	0,07	0,54
Percentage load	31,8 %	48,7 %	71 %

F1 is crystallizing in this group and includes five characteristics: three basic beliefs indices and categoric abilities of associative and involuntary categorization. This factor is characterized by basic beliefs and conceptual structures integration.

F2 includes indices of the "resource" notion conceptual experience and mental representation, i.e., the students of this group create (plan) their resource from the point of view of understanding.

F3 includes the indices of the "resource" notion conceptual synthesis and cognitive content and amplify the indices of the second factor.

It should be mentioned that the factor structure of the students' semantic, categoric and conceptual abilities coherence with their basic beliefs is harmonic; i.e., the conceptual structures and basic beliefs of the students included into this group systematically form and develop and create an integrated individual personal resource. Students' success and their abilities and qualities further development directly depend on the level of personal resource formedness.

The students of the fourth cluster (group 4) characterized by high conceptual structures and basic beliefs formedness indices showed that the summary dispersion here is 81.3 per cent.

The three-component full factor structure resulted from rotation (Table 4).

**Table 4**  
*Factor structure of the students' semantic, categoric and conceptual abilities indices coherence with their basic beliefs ones (group 4 - with high results)*

Characteristics	Components		
	F1	F2	F3
CG	<b>-0,86</b>	0,12	-0,03
CS	0,06	0,94	0,08
IC	0,29	0,21	<b>0,88</b>
CC	<b>0,82</b>	-0,10	0,45
PS	-0,54	<b>0,70</b>	-0,18
PVI	0,19	-0,02	<b>0,93</b>
BW	0,08	<b>0,66</b>	0,24
WU	-0,04	0,57	<b>0,66</b>
SF	<b>0,90</b>	0,28	0,14
Percentage load	29,3	54,7	81,3

F1 combines such directly correlated indices as self-worth, ability to control the events and luck, "resource" concept cognitive content and inversely correlated index of categoric generalization. That means that the students point out different sufficient signs of the "resource" concept in different situations.

Two other factors have the signs of intellectual and personal resource integration.

F2 is represented by direct correlation of conceptual synthesis, conceptual experience concerning the "resource" stimulus, general attitude to the benevolence of the world, belief in good prevailing over evil and good people number prevailing over bad one.

F3 includes directly correlated indices of involuntary categorization, the "resource" concept mental representation and attitude to meaningfulness of the world.

The fifth group (it 6.3 per cent of all students and is characterized by an extraordinary indices of the conceptual structures and basic beliefs formedness level) results factorization showed the summary dispersion of 100 per cent. The three-component factor structure resulted from rotation (Table 5).

**Table 5**  
*Factor structure of the students' semantic, categoric and conceptual abilities indices coherence with their basic beliefs ones (group 5 - with extraordinary results)*

Characteristics	Components		
	F1	F2	F3
CG	-0,67	<b>0,65</b>	0,36
CS	-0,06	<b>0,98</b>	-0,16
IC	<b>0,96</b>	0,28	-0,08
CC	-0,15	<b>-0,97</b>	0,18
PS	-0,13	0,44	<b>-0,89</b>
PVI	<b>0,98</b>	-0,06	-0,17
BW	0,63	<b>0,69</b>	0,36
WU	<b>0,97</b>	-0,05	0,23
SF	-0,13	0,10	<b>0,99</b>
Percentage load	41,4	75,8	100

F1 consists of such directly correlated indices as general attitude to the meaningfulness of the world, "resource" concept mental representation, involuntary categorization and inversely correlated categoric generalization. These students handle class-descriptive categories found and defined on their own; they call these categories in their own way through the lens of sufficient index and sign. At the same time, their attitude to the world is meaningful and they structure the image of their intellectual and personal resource.

F2 includes directly correlated indices of the general attitude to the benevolence of the world, conceptual synthesis and inversely correlated index of the "resource" concept cognitive content. This factor as well as the first one expresses peculiarities of the personal resource and formedness of the conceptual synthesis studied as the sign of highly-developed conceptual abilities. These abilities are a "peak" of the conceptual structures development.

F3 is formed by directly and inversely correlated indices of conceptual experience concerning the "resource" stimulus and self-worth as well as the ability to manage and control the events and luck. It can be supposed that the students of this group are not satisfied with themselves and their achievements and gains.

The results of the factor analysis let us state that each group of students is characterized by specific peculiarities of the conceptual structures and basic beliefs correlations.

## Discussions

The results received during the research demonstrate that the students included into the groups revealed in a course of a groups clustering, have various levels of involuntary intellectual control; this fact is a testimony to different levels of intellectual, emotional, motivational, spiritual and axiological resources integration. Different levels of personal success awareness, realizing different levels of gained

experience connection with the "resource" as well as different levels of conceptual experience indicate different degrees of these structures being integrated into the general intellectual and personal resource of students. Significant differences in levels the of basic beliefs formedness prove that students have absolutely different understanding of the world and of themselves. Their beliefs in positive moments predomination over bad ones, in a fact that events can be controlled and their ability to manage and control these events also differ a lot.

Thus, the fact of semantic, categoric, conceptual abilities of the students being formed and coherent with their basic beliefs is statistically confirmed, has a level-based character and can be classified. The basis for classification is the degree of the students' conceptual abilities and basic beliefs development indices coherence (homogeneity).

Five factor structures are defined in a course of studying the qualitative characteristics of the students' conceptual abilities and basic beliefs development indices coherence; these characteristics describe directions of the basic beliefs and conceptual thinking structures relations in each group.

The first group includes the students with poorly developed conceptual structures and basic beliefs. They are characterized by low semantic, categoric and conceptual abilities formation values as well as by low level of "Benevolence of the World", "Meaningfulness of the World" and "Self-Worth" concepts formation. The description of this group students' basic beliefs and conceptual structures connection shows that the general level of the basic beliefs coherence with the mental representation of the concepts regarding their success as well as with the arbitrary form of controlling the states of their individual resource is in contradiction with the involuntary control of the intellectual resource and the ability to operate on the gained experience in general. The characteristics of the students included into this group are of a narrow equivalence range ("analyticity"). These results indicate lower rates of involuntary and voluntary memorizing; cognitive rigidity, ability to operate and use accurate concept structures rather than abstract ones.

The second group includes the students with medium-low conceptual structures and basic beliefs formedness indices. This group is characterized by contradictions between "Success", "Self-Worth" and "Meaningfulness of the World" conceptual experience formedness. These students are also characterized by the lack of awareness of their capabilities to form an image of themselves in the surrounding world. They do realize and understand what is going on and what should be, but they are unable to identify themselves in these very conditions. Intellectual and personal resources are poorly integrated because conceptual structures and basic beliefs are underdeveloped, inharmonic and are contradictorily connected. These facts characterize these young people's individual resource as unstable and unformed.

The third group is represented by students with a mean (average) conceptual structures and basic beliefs formedness indices. Despite the fact that students of this group are characterized by mean (average) semantic, categoric and conceptual abilities and basic beliefs formedness indices, the character of these structures connection in this group is the most harmonious. This fact allows us to conclude that the students with mean (average) indices are characterized by steady personal and intellectual resources characteristics integration; this kind of integration is the predictor of the students' socialization success. Their conceptual abilities and basic beliefs form an integrated individual resource; the students' successful socialization and their general success depend on the level of this individual resource formedness.

The fourth group of students having high conceptual abilities and basic beliefs rates and their harmonious coherence structure, is characterized by a contradiction between the level of voluntary categorization and the ability to operate the concepts variety. This fact proves, that no matter all the variables are well formed in this group, these students make inflated demands on their resource and capabilities. In our view, it can be concluded that the students with highly developed conceptual abilities and basic beliefs are more demanding of themselves, of society and of the world as a whole. They have to alter the conceptual field standard boundaries to harmonize the intellectual and personal resource development.

The fifth group is small-numbered, but is of great interest for additional research. This is a group of students with outstanding conceptual structures and basic beliefs formedness indices. These students show the necessity of concepts standard boundaries alteration as the students of previous group. Moreover, there are some contradictions between correlations of the personal resource from gained experience with the "Benevolence of the World" and conceptual experience with "Self-Worth". Hypothetically, this contradiction suggested that such students presented their resources in an unusual and nontypical manner. Deeper integration with personal characteristics gives these students an opportunity to reflect and correlate their resources and capabilities with standard and required ones. However outstanding conditions are necessary in addition to generally accepted standards to develop the potential of students. This is due to the effect of indices "splitting" in case of very high conceptual structures results and is

accompanied by a number of specific effects, connected, in particular, with structural bonds breakdown.

## Conclusions

The conclusion that the students' conceptual abilities and basic beliefs form their intellectual and personal resource is a result of the empirical research.

The coherence between basic beliefs and conceptual structures (semantic, categoric and conceptual abilities) formedness is conditioned by their being connected.

Thus, the students whose ideas in "Benevolence of the World", "Controllability", "Self-Worth", confidence in their ability to manage the events are well-formed and well-developed are characterized by the high conceptual structures indices. The conceptual structures of the students with malformed basic beliefs are poorly developed.

The students' abilities (semantic, categoric, conceptual) formedness coherence with their basic beliefs is level-based and represents the classification of their connections, which is reflected in structural features.

However, the structures are changed when the mean (average) results are exceeded. This scientific fact is confirmed by the phenomenon of an intellectual resource "splitting": the intellectual resource can split into productive (intellectual maturity) and non-productive components in case of the high intelligence indices. This phenomenon can lead to an intellectual resource limited development and to its basic components insufficient formedness.

Thus, the analysis of the students' conceptual structures and basic beliefs coherence was conducted for the first time; the psychological ambivalence of the students' conceptual structures and basic beliefs coherence was empirically shown and proved taking into account nonlinearity phenomena, indices interdependence and intellectual resource "splitting" into productive and non-productive components.

The group with very high conceptual structures and basic beliefs indices definition allows making an integrated idea of some students' intellectual and personal resource peculiarities and is a good basis for the following research.

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### Conflict of interests

The authors declare no conflict of interest.

## References

- Artemova, Ya. V., & Lezhnina, O. A. (2016). О взаимосвязи когнитивных факторов и экзистенциальных оснований личности в психологической науке: открытия и проблемы [About connection of cognitive factors and existential bases of a person in Psychological Science: inventions and problems]. *Human capital*, 9(93), 74-79. Retrieved from <https://elibrary.ru/item.asp?id=27009296>
- Belyaeva, T. B., & Куорпель, М. В. (2018). Взаимосвязь психологического благополучия с базисными убеждениями старшеклассников [Psychological well-being correlation with basic beliefs of senior high-school students]. The Herzent University Conference on Psychology in Education, Materials of the Conference. *Novgorod State University named after Yaroslav the Wise*, 1(1), 158-166. Retrieved from <https://elibrary.ru/item.asp?id=42937940>
- Bonanno, G. A. (2004). Loss, Trauma, and Human Resilience: Have We Underestimated the Human Capacity to Thrive After Extremely Aversive Events? *American Psychologist*, 59(1), 20-28. <https://doi.org/10.1037/0003-066X.59.1.20>
- Budakova, A. V., & Matsuta, V. V. (2016). Различия в показателях личностного потенциала у высокоинтеллектуальных студентов [Differences in the highly intellectual students' personal potential]. *Annals of Novosibirsk State Pedagogical University*, 6(34), 17-30. <http://dx.doi.org/10.15293/2226-3365.1606.02>
- Bulman, R.J., & Timko, C. (2020). Working with victims: Changes in the researcher's assumptive world (Book Chapter). *Advances in Environmental Psychology (Volume 5): Methods and Environmental Psychology*, 75-97. <http://dx.doi.org/10.4324/9781003052944-3>
- Dekel, R., Solomon, Z., Elklit, A., & Ginzburg, K. (2004). World assumptions and combat-related posttraumatic stress disorder. *The Journal of social psychology*, 144(4), 407-420. <http://dx.doi.org/10.3200/SOCP.144.4.407-420>
- Dzuka, J., & Dalbert, C. (2006). The belief in a just world and subjective well-being in old age. *Aging and Mental Health*, 10(5), 439-444. <http://dx.doi.org/10.1080/13607860600637778>
- Elshanskij, S. P. (2020). Исследования когнитивных аспектов эффективности обучения в современной

- отечественной и зарубежной психологической науке. Когнитивная и мотивационно-смысловая сферы личности: монография [Research on cognitive aspects of education efficiency in modern indigenous and foreign Psychological Science. Cognitive and motivation and conceptual spheres of person: monograph]. Edited by E. B. Puchkova and E. A. Sorokoumova. Moscow: Moscow Pedagogical State University, pp. 194, 18-25. Retrieved from <https://elibrary.ru/item.asp?id=43823501>
- Gavrilova, T. A., & Leshcheva, I. A. (2013). Понятийные структуры знаний и когнитивный стиль. [Conceptual structures of knowledge and cognitive style]. *Psychology, Journal of the Higher School of Economics*, 13(1), 154–176. <http://dx.doi.org/10.17323/1813-8918-2016-1-154-176>
- Goldenberg, I., & Matheson, K. (2005). Inner representations, coping, and posttraumatic stress symptomatology in a community sample of trauma survivors. *Basic and Applied Social Psychology*, 27(4), 361-369. [http://dx.doi.org/10.1207/s15324834basps2704\\_9](http://dx.doi.org/10.1207/s15324834basps2704_9)
- Hazova, S. A. (2016). «Неакадемические» способности: роль и ресурсные функции в совладающем поведении субъекта [Nonacademic abilities: role and resource functions in a subject's coping behaviour]. *Psychological researches*, 9(49), 2. Retrieved from <http://psystudy.ru/index.php/num/2016v9n49/1337-khazova49.html>
- Hazova, S. A. (2018). Ментальные ресурсы субъекта. Разработка понятий современной психологии [The subject's mental resources. Development of concepts in modern Psychology]. Edited by E. A. Sergienko, A. L. Zhuravlev and G. A. Vilenskaya. Moscow: Institute of Psychology of the Russian Academy of Sciences Publ., 2, 63–82. <https://www.elibrary.ru/item.asp?id=35641806>
- Holodnaya, M. A., Trifonova, A. V., Volkova, N. E., & Sipovskaya, Ya. I. (2019). Методики диагностики понятийных способностей [Methods of the conceptual abilities diagnostics]. *Experimental Psychology*, 12(3), 105–118. <https://doi.org/10.17759/exppsy.2019120308>
- Holodnaya, M. A. (2019). Психология интеллекта. Парадоксы исследования. [Psychology of intelligence. Antinomies in research]. 3<sup>rd</sup> edition revised and enlarged. Moscow: Urait Publ. Retrieved from <https://urait.ru/bcode/422937>
- Holodnaya, M. A., & Hazova, S. A. (2017). Феномен концептуализации как основа продуктивности интеллектуальной деятельности и совладающего поведения. [Conceptualization as the basis of intellectual activity and coping behaviour efficiency]. *Psychological journal*, 38(5), 5-17. <http://dx.doi.org/10.7868/S0205959217050014>
- Jeavons, S., & Greenwood, K. M. (2007). World assumptions, coping and attributions. *Personality and Individual Differences*, 42(7), 1427-1437. <https://doi.org/10.1016/j.paid.2006.11.010>
- Kibal'chenko, I. A., Eksakusto, T. V., & Istratova, O. N. (2017). Интеллектуально-личностный ресурс субъекта развития: теоретические основы [Intellectual and personal resource of the subject of development: Theoretical foundations]. Taganrog, Southern Federal University Publ. pp. 160. Retrieved from <https://elibrary.ru/item.asp?id=32323271>
- Kibal'chenko, I. A., Istratova, O. N., & Eksakusto, T. V. (2019). Опыт отношений в родительской семье как предиктор интеллектуально-личностного ресурса молодых людей: монография [Parental family relations experience as a predictor of young people intellectual and personal resource: monograph]. Rostov-on-Don; Taganrog, Southern Federal University Publ. pp. 203 Retrieved from <https://www.elibrary.ru/item.asp?id=41715984>
- Kibal'chenko A., I., & Eksakusto V., T. (2020). Cognitive and style predictors of the students' psychological well-being. *International Journal of Cognitive Research in Science, Engineering and Education*, 8(1), 1–13. <https://doi.org/10.5937/IJCRSEE2001001K>
- Lahav, Y., Bellin, E. S., & Solomon, Z. (2016). Posttraumatic growth and shattered world assumptions among ex-POWs: the role of dissociation. *Psychiatry*, 79(4), 418-432. <https://doi.org/10.1080/00332747.2016.1142776>
- Lifshits, M. V. (2019). Взаимосвязь базовых убеждений, насыщенности жизни стрессом и психологического благополучия. [Basic beliefs connection with life filled with stress and psychological well-being]. *Human capital*, 10(130), 126-132. Retrieved from <https://elibrary.ru/item.asp?id=41137921>
- Lilly, M. M. (2011). The contributions of interpersonal trauma exposure and world assumptions to predicting dissociation in undergraduates. *Journal of Trauma & Dissociation*, 12(4), 375-392. <https://doi.org/10.1080/108015299732.2011.573761>
- Major, B., Richards, C., Cooper, M. L., Cozzarelli, C., & Zubeck, J. (1998). Personal resilience, cognitive appraisals, and coping: an integrative model of adjustment to abortion. *Journal of personality and social psychology*, 74(3), 735-752. <https://doi.org/10.1037/0022-3514.74.3.735>
- Maksimović, J., & Osmanović, J. (2019). Perspective of cognitive thinking and reflective teaching practice. *International Journal of Cognitive Research in Science, Engineering and Education*, 7(2), 1–10. <https://doi.org/10.5937/IJCRSEE1902001M>
- Mazor, Y., Geikopf, M., & Roe, D. (2020). Posttraumatic growth in psychosis: Challenges to the assumptive world. *Psychological Trauma: Theory, Research, Practice, and Policy*, 12(1), 3. <https://doi.org/10.1037/tra0000443>
- McCaslin, M. L., & Kilrea, K. A. (2019). An Introduction to Transformative Inquiry: Understanding Compelling and Significant Relationships for Personal and Societal Transformation. *The Qualitative Report*, 24(5), 980-1000. Retrieved from <https://nsuworks.nova.edu/tqr/vol24/iss5/4>
- Mikkelsen, E. G. (2001). Workplace bullying: Why and for whom is bullying such a strain. *Nordisk Psykologi*, 53(2), 109-131. <https://doi.org/10.1080/00291463.2001.11863991>
- Monden, K. R., Trost, Z., Scott, W., Bogart, K. R., & Driver, S. (2016). The unfairness of it all: Exploring the role of injustice appraisals in rehabilitation outcomes. *Rehabilitation psychology*, 61(1), 44. <https://doi.org/10.1037/rep0000075>
- Padun, M. A., & Kotel'nikova, A. V. (2012). Психическая травма и картина мира: теория, эмпирия, практика. Монография [Psychological trauma and the picture of the world: theory, empiricism and practice. Monograph]. The prospects of Psychology. Moscow: Institute of Psychology of the Russian Academy of Sciences Publ., pp. 206. Retrieved from <https://www.elibrary.ru/item.asp?id=19135345>
- Padun, M. A., & Kotel'nikova, A. V. (2008). Модификация методики исследования базисных убеждений личности Р. Янофф-Бульман [Modification of basic personality beliefs research method of R. Janoff-Bulman]. *Psychological journal*, 29(4), 98-106. Retrieved from <https://elibrary.ru/item.asp?id=11032506>
- Pulyaeva, V. N., & Nevryuev, A. N. (2020). Взаимосвязь базовых психологических потребностей, академической мотивации и отчуждения от учебы обучающихся в системе высшего образования [The Relationship of Basic Psychological Needs, Academic Motivation and Alienation from Study of Students in Higher Education]. *Psychological*

- science and education, 25(2), 19-32. <https://doi.org/10.17759/pse.2020250202>
- Quillien, T. (2020). When do we think that X caused Y?. *Cognition*, pp. 205, 104410. <https://doi.org/10.1016/j.cognition.2020.104410>
- Shelegina, A. Ya. (2018). Онтологическая уверенность и базовые убеждения личности как предикторы психологического благополучия. [The person's ontological confidence and basic beliefs as predictors of psychological well-being]. *Lomonosov Conference in Altay: fundamental problems of Science and Engineering. Bulletin of scientific articles of an international conference: electronic resource*. Edited by Rodionov, E.D. Barnaul: Altay State University Publ., 1583-1584. Retrieved from <https://elibrary.ru/item.asp?id=36972443>
- Shi, L., Sun, J., Wu, X., Wei, D., Chen, Q., Yang, W., ... & Qiu, J. (2018). Brain networks of happiness: dynamic functional connectivity among the default, cognitive and salience networks relates to subjective well-being. *Social cognitive and affective neuroscience*, 13(8), 851-862. <https://doi.org/10.1093/scan/nsy059>
- Ter Heide, F. J. J., Sleijpen, M., & van der Aa, N. (2017). Posttraumatic world assumptions among treatment-seeking refugees. *Transcultural psychiatry*, 54(5-6), 824-839. <https://doi.org/10.1177/1363461517741811>
- Trifonova, A. V. (2016). Вклад понятийных способностей в развитие интеллектуального ресурса личности. [Conceptual abilities contribution to person's intellectual resource development]. *Psychological researches*. Edited by A/L/ Zhuravlev, E.A. Sergienko. Moscow: Institute of Psychology of the Russian Academy of Sciences Publ., 8, 155-166 Retrieved from <https://elibrary.ru/item.asp?id=26784457>
- Trzebiński, J., Cabański, M., & Czarnecka, J. Z. (2020). Reaction to the COVID-19 pandemic: the influence of meaning in life, life satisfaction, and assumptions on world orderliness and positivity. *Journal of Loss and Trauma*, 25(6-7), 544-557. <https://doi.org/10.1080/15325024.2020.1765098>
- Tsvetkov, M.A. (2020). Влияние базисных убеждений на взаимодействие родителя и ребенка. [Basic beliefs influence on a parent interaction with a child]. *International Electronic Scientific Journal*, 3(74), 141-145. Retrieved from <https://elibrary.ru/item.asp?id=44002216>
- Volkova, N. N., & Gusev, A. N. (2016). Когнитивные стили: дискуссионные вопросы и проблемы изучения. [Cognitive styles: Controversial issues and research problems]. *National Psychological Journal*, 2, 28-37. Retrieved from <https://elibrary.ru/item.asp?id=27536968>
- Ward, T., & Plagnol, A. (2019). Cognitive psychodynamics as an integrative framework in counselling psychology and psychotherapy. *Springer International Publishing*. [https://doi.org/10.1007/978-3-030-25823-8\\_7](https://doi.org/10.1007/978-3-030-25823-8_7)
- Załuski, M. (2015). The worldview contained in declarations of police officers scheduled for psychotherapeutic treatment. [Obraz Świata Zawart Y W Dekl Aracjach Pol Icjantów Zakwalifikowanych Naleczenie Psychot Erapeutyczne] *Psychoterapia*, (2), 57-70. <https://doi.org/10.12740/PT/42010>

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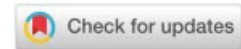
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# The Ratio of Verbal and Nonverbal Components of Individual Cognitive Maps as a Reflection of the Collaborative Thinking Activity of Its Participants

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**Abstract:** The presented results of the study allow us to determine the ratio of verbal and nonverbal components of thinking activity in solving problems of different types. The novelty of the research is in the use of individual cognitive maps made on the results of collaborative thinking activity in the study of possible combinations of symbolic (verbal) and figurative (nonverbal) components of internal thought processes implemented in different conditions. The study included two methodological blocks. The first of them is diagnostic. It consisted of four tasks (a verbal task with one solution, a verbal task with multiple solutions, a nonverbal task with one solution, a nonverbal task with multiple solutions), as well as a cognitive map based on the results of solving these tasks. The second block is mathematical and statistical, including the Kruskal-Wallis H-test, the Mann-Whitney U-test, and the Fried-man chi-square test. The study sample consisted of 80 students of the Don State Technical University. As a result of the study, it was found that cognitive maps created with time constraints significantly outperform cognitive maps created without such restrictions in terms of figurative, symbolic abstractness and symbolism. Cognitive maps created without time constraints significantly outperform cognitive maps created with time constraints in terms of imagery. In general, the predominance of the verbal or nonverbal components of thinking can vary significantly, but the general trend towards the predominant character of the imagery of thought processes remains.

*Keywords:* thinking activity, cognitive map, mental map, components of thinking activity.

## Introduction

The theory and practice of cognitive mapping is extremely diverse. The concept of this phenomenon changed from an image that captured the external reality to a complex network of verbal and nonverbal representations (Solso, MacLin, and MacLin, 2014; Eden, 2004; Nesbit and Adescope, 2006). However, despite all this diversity, cognitive maps, as a rule, tend to be considered more as a convenient tool for thinking than a tool for understanding the psyche. Such understanding exists despite the fact that it is cognitive maps, due to their projective nature, that allow us to present internal thought processes in an external form that is accessible to the researcher (Solso, MacLin, and MacLin, 2014; Nesbit and Adescope, 2006). This also applies to the manifestations of the unconscious and, most importantly, the interaction of conscious and unconscious processes of the human psyche. Many questions of this interaction remain unclear, and it is largely unclear how the various manifestations of the conscious and unconscious relate to each other. The study of the ratio of verbal and nonverbal components of cognitive maps allow us to look deeper into the internal mental processes, to understand what conscious and unconscious mechanisms are involved in the implementation of thinking activity (Bottini and Doeller, 2020; Nanay, 2021).

The first mention of this term was made by E. Tolman in 1948 (Tolman, 1948). His research was continued, at the level of human thinking in the work of R. Downes, D. Stey, (Downs and Stea, 2017). In this study, along with the concept of "cognitive map", another one was used – "psychological map". In general, a psychological map is a structured and ordered representation of reality, making it more concrete, but not reducible to model stimuli.

Another similar term in terms of content is the "mental map" considered in line with the concepts

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of K. Lynch, S. Milgram and S. Fauconnier (Filomena, Verstegen and Manley, 2019; Milgram, 1970; Fauconnier, 2018). By mental maps, these researchers meant an image of how a person imprints the object world around him in his mind (Milgram, 1970; Beel and Langer, 2011).

In the future, the term “cognitive map” was interpreted more and more broadly, in the form of a metaphor for a certain set of ideas. So J. L. Bellmund defines the cognitive map as a set of visual representations of reality, a kind of mental images as such (Bellmund et al., 2018). Subsequently, the idea of cognitive maps as exclusively visual representations is questioned. A number of researchers are beginning to perceive it more as a conceptual scheme. In this capacity, under the name “concept map”, it was first described by J. Novak. It is presented as a technique of visual representation of the information structure, which reflects the interaction of concepts in the conceptual field (Novak, 2010; Cañas, Novak and Reiska, 2015). Further development, but already under the name of the intellect map or mind map, the conceptual map was received in the works of T. Buzen, which in his view is a graphic representation of semantic, causal or associative connections between concepts, parts and components of the considered area (Behrens, et al. 2018; Sadoski and Paivio, 2013). Thus, the cognitive map, along with the nonverbal, imaginative dimension, has a second – verbal dimension, and the problem of the interaction of these two components in the human psyche arises.

One of the first works devoted to the problem of the correlation of verbal and nonverbal forms in the dynamics of thinking activity was the work of A. Paivio. In his research, he came to the assumption of the existence of two coding systems — figurative and symbolic (Sadoski and Paivio, 2013; Paivio, 2011).

R. Finke, testing the hypothesis of A. Paivio, came to the conclusion that both codes can be implemented in human thinking activity either together or separately from each other (Ward, Finke and Smith 2013; Palmiero, et al., 2019).

The presence of psychic constructs confirms this possibility. Mental constructs are verbal concepts that construct the essence of the surrounding world (Palmiero, et al., 2019). According to N. Smith, the mental construct is a product of theorizing and abstraction, i.e., the complete opposite of the figurative representation of reality (Ward, Finke and Smith 2013).

However, in their recent studies of mnemonic processes, A. Paivio and M. Sadoski, determined that when working with information, a person uses both methods of encoding. Initially, the incoming information is translated into figurative, and only then into verbal form, and in the case of abstract concepts, images act as “hints” that facilitate thinking activity (Sadoski and Paivio, 2013).

The transition of symbolic processes into visual ones and, conversely, in cognitive maps is often barely perceptible, and in most cases is realized by a person on an unconscious level (Solso, MacLin and MacLin, 2014; Rosch, 2011; Park et al., 2020).

R. McAleese, developing the ideas of P. Chandler, in a number of his articles, speaks about the ability of a person, using cognitive maps, to be aware of the information received, extracting it from the unconscious, to clearly see the process of thinking (McAleese, 1998; Sweller, 2020).

A number of researchers believe that the conscious and unconscious are not just different areas of the psyche, acting as repositories of thoughts and memories, they have different ways of interacting with the surrounding reality (Sadoski and Paivio, 2013; Dehaene et al., 2014). In this case, we can already talk about the cognitive conscious and the unconscious. These terms, introduced into scientific use by P. Rozin back in 1976, are still not well established. The idea of the cognitive unconscious was developed by S. Epstein, and later by a number of other specialists in cognitive psychology (Epstein, 2012). To date, the cognitive unconscious is understood as the processing of information that occurs in addition to thought, bypassing consciousness. B. Baars generalized the ideas of S. Epstein and a number of other cognitive psychologists, created the theory of the global workspace. According to B. Baars, consciousness arises from the unconscious or preconscious, forming a global workspace (Baars, 2017). Cognitive neuropsychologist S. Dehaene, while studying the mechanisms of translation from unconscious perception to conscious perception, came to the conclusion that all events that occur in consciousness must initially occur in the unconscious and have a nonverbal form (Dehaene, 2011; Dehaene et al., 2014). D. Stern emphasized that the basis for the unconscious is nonverbal thinking, based on the language of images, and the basis of conscious is logical-verbal thinking, operating with verbal representations (Stern, 2015). A. Dijksterhuis, after a series of experiments, came to the conclusion that since a significant part of memory is unconscious, unconscious thinking is superior to conscious thinking in those areas that require a qualitative, simultaneous comparison of many alternatives (Dijksterhuis and Aarts 2010). Consequently, beyond the boundaries of consciousness are phenomena that are not subject to verbal processing, but are processed at the nonverbal level, forming the sphere of the cognitive unconscious. Of course, conscious is not limited to the verbal form, just as the unconscious is not limited to nonverbal forms. However, the verbal for conscious, as well as the nonverbal for the unconscious, are an absolute basis, as confirmed by

numerous studies in cognitive psychology, psychophysiology, and neuropsychology (Sadoski and Paivio, 2013; Dehaene, 2011; Stern, 2015; Behrens, et al. 2018).

Thus, the process of interaction of the verbal and nonverbal components of the subject's thought processes in the cognitive map makes it possible to trace how the unconscious component of the psyche, which is reflected in the visual form, interacts with the conscious component, which reflects the verbal and logical component of the psyche.

The study of such transitions in cognitive maps at the level of joint activity allows us to study it in a manifest, external form, whereas in individual activity, phenomena are inaccessible to an external observer, because of their convolution and non-manifestation in an external, observable form.

## Materials and Methods

The study involved 80 subjects (24 men and 56 women) aged 20 to 24 years. Subjects – bachelors of the 3-4 courses and masters of the 1 course (humanities and technical specialties) of Don State Technical University.

In the course of the study, each student group was asked to divide into subgroups of four people each, based on their personal preferences. A total of 20 small groups were obtained.

The formed groups of subjects were given four tasks. Half of the groups of subjects received the first and second tasks to solve, the second half of the groups were given the third and fourth tasks. This was done to ensure that the subjects solved the most different problems from each other, and the experience of solving one problem did not affect the solution of the other. In addition, half of the subjects solved the problems without having a time limit. The other half, had to meet a certain time frame, when solving problems. This was done to stimulate the unconscious component of thinking, which increases with a decrease in the resource of time.

The first of them was to remove a certain number of lines that make up the sides of a square and add a certain number of lines in return, to get a different number of squares than what was originally presented in the conditions of the problem. You need to find only one option that fully meets the conditions of the problem. To facilitate the thought process, its greater clarity, the squares were assembled from matches. The second task was to find a way to break a vase full of water, located in a locked room, without leaving a trace, while being in the building opposite. In this case, it was necessary to offer all possible ways that guaranteed success. The third task asks the subjects to draw three straight lines, through four points arranged in squares, without lifting the pencil from the sheet of paper so that all the points are connected, and the pencil returns to the starting point. It was necessary to find all possible ways to do this. The fourth task is about two twins, one of whom must be caught in a lie knowing that one of them always tells the truth, and the other always lies. It is necessary to find the only possible formulation that allows this to be done.

Each of the proposed tasks has a certain combination of parameters. The first task is nonverbal in nature and has a single solution within the framework of the formulated conditions. The second task is verbal, having many ways to solve it. The third task is nonverbal in nature, and has many possible solutions. The fourth task is verbal in nature, also having only one solution. Thus, the four tasks are a combination of certain parameters highlighted as the main ones and allow you to alternately use certain components of the psyche.

Thus, the verbal nature of the task inclines the subjects to engage in verbal-logical thinking, which is based on the conscious component of the psyche, while nonverbal tasks, on the contrary, promote the use of imaginative thinking and, therefore, rely more on the unconscious component of the psyche. The presence of provided alternatives in the results of solving the problem should also contribute to the activation of the conscious, if there are several possible solutions or activation of the unconscious, the latter better copes with the need for a qualitative comparison of alternatives among themselves, to choose the only way to solve the problem.

Before working with the tasks, all the subjects were informed whether the task has one or more solutions.

After solving all the problems, students were asked to individually depict the process of group solving one of the four problems in a graphical form. Each of them could represent the solution of only one problem. Students were not required to seek help from other members of the group. Before starting work, the study participants had to agree with each other on the solutions to which problem they would represent. This was done to get an equal number of images for each of the presented tasks. At the same time, those subjects who solved problems in the presence of time constraints were instructed to build

a cognitive map for a certain period of time, equal to three minutes. This was done so that the study participants did not have time to create a conscious plan for the future map and were forced to rely on the unconscious component of the psyche. The other half of the subjects did not have such restrictions, and could more consciously approach the creation of a cognitive map. Thus, ten cognitive maps were obtained for each of the tasks.

The drawn image created by the student could have explanations in the form of individual words or short phrases. Assignments for students were submitted in a free form, with high uncertainty. Thanks to this, the construction of cognitive maps was made less formal, which contributed to a more flexible approach to their representation and allowed us to overcome the limitations of focusing on the formal criteria of cognitive maps. The resulting cognitive maps were evaluated according to four indicators.

The first such indicator was figurative abstractness, understood as the presence of images distant from specific images. The number of abstract images was taken into account, the more of them, the higher the abstractness of the cognitive map. The presence of 25% or less of abstract images from the total number in the drawing indicated a low abstractness. From 25% to 50% of abstract images meant that the map has an average level of abstractness. If such images were from 50% to 75 %, the abstractness of the cognitive map was defined as high, more than 75 % as very high. Thus, a particular cognitive map could get from 1 point for low abstractness to 4 points for high abstractness.

The second indicator was symbolic abstractness, understood as the degree of remoteness of the verbal component of the map from specific concepts. The method of evaluation was the same as in the first case.

The third indicator is imagery (nonverbality), defined as the number of images used in the cognitive map. The number and method of awarding points was the same as in the case of the previous indicator.

The fourth indicator is symbolism (verbality). This is the number of verbal objects in the cognitive map. If the number of words did not exceed 4, then the symbolism was determined as low and was indicated by one point. The cognitive map, which included from 5 to 8 words, was defined as having an average level of symbolism, which brought 2 points. A map in which from 9 to 12 objects were determined to have a high level and were rated at 3 points. A map with more than 12 objects was defined as having a very high level of symbolism, which was estimated at 4 points.

Mathematical and statistical data processing was performed using the Kruskal-Wallis H-test, the Mann-Whitney U-test, and the Friedman chi-square test.

## Results

The indicators of cognitive maps were brought to the average values for each of the four tasks. The results obtained are divided into five main blocks. The first section provides data on the differences in each individual indicator of cognitive maps based on the results of solving all types of tasks, by those subjects who were not limited in time when creating these maps. The second section provides data on the differences between all the indicators of cognitive maps, performed as a result of solving each individual type of tasks, by subjects who were not limited in time when creating these maps. The third section provides data on the differences in each individual indicator of cognitive maps based on the results of solving all types of tasks, by those subjects who were limited in time when creating maps. The fourth block provides data on the differences between all the indicators of cognitive maps, performed as a result of solving each individual type of tasks, by subjects who were limited in time when creating maps. The fifth block demonstrates the results of the study on the presence of differences between the indicators of the cognitive maps of the subjects who were limited in time, and those for whom there were no such restrictions. To obtain the results of the first and third blocks, the Kruskal-Wallis H-test was used. To obtain the results of the second and fourth blocks of the criterion, the Friedman chi-square was used. To get the results of the fifth block, use the Mann – Whitney U-test.

Table 1 shows the results of a study of the differences between the indicators of cognitive maps performed after solving all four tasks, without time limits.

**Table 1**  
*Differences in each individual indicator of cognitive maps performed without time constraints, based on the results of solving all types of tasks*

Types of tasks	Indicators of cognitive maps							
	Figurative abstractness		Symbolic abstractness		imagery		Symbolism	
	Average values	Difference indicator	Average values	Difference indicator	Average values	Difference indicator	Average values	Difference indicator
Task 1 Nonverbal, with one solution option	2,9		1,6		3,4		2,2	
Task 2 Verbal, with multiple solutions	1,6		1,9		2,1		3,1	
Task 3 Nonverbal, with multiple solutions	2,0	13,87**	2,0	3,21	2,7	19,31**	3,0	10,32*
Task 4 Verbal, with one solution option	2,0		1,6		2,1		2,1	

Note: \*\*\* $p \leq 0,001$ ; \*\* $p \leq 0,01$ ; \* $p \leq 0,05$ .

According to the presented data, significant differences obtained using the Kruskal-Wallis H-test were found between such indicators of cognitive maps as figurative abstractness (hemp.=13.87;  $p \leq 0.01$ ), imagery (hemp.=19.31;  $p \leq 0.01$ ) and symbolism (hemp.=10,32;  $p \leq 0,05$ ). At the same time, the subjects showed the highest indicators of figurative abstractness of cognitive maps when solving the first task (2.9), which has a nonverbal character and is limited to one correct solution. The imagery of the cognitive map was the highest, according to the results of solving the first problem (3.4), as well as in the case of figurative abstraction. The highest indicators of the symbolism of the cognitive map are demonstrated by the subjects after solving the second task – verbal, with several solutions. The differences in such an indicator as symbolic abstractness were insignificant.

Cognitive maps based on the results of verbal tasks are inferior in figurative abstractness and imagery to maps made after solving nonverbal tasks. The figurative abstractness is higher in those maps that were created based on the results of solving a problem with one correct answer. High levels of symbolism are demonstrated by those cognitive maps that were created as a result of solving problems with multiple solutions, whether they were verbal or nonverbal. The index of imagery is higher in those cognitive maps that were created after solving problems with one correct answer, but they were higher after solving nonverbal problems than after solving verbal ones.

After describing the results of comparing the indicators of cognitive maps performed on the basis of different types of tasks, we will consider the data on the differences between all the indicators of cognitive maps performed on the basis of solving each individual type of tasks. The results are presented in table 2.

**Table 2**

*Differences between all indicators of cognitive maps performed without time constraints, based on the results of solving each individual type of task*

Indicators of cognitive maps	Types of tasks							
	Task 1		Task 2		Task 3		Task 4	
	Nonverbal, with one solution option		Verbal, with multiple solutions		Nonverbal, with multiple solutions		Verbal, with one solution option	
	Average values	Difference indicator	Average values	Difference indicator	Average values	Difference indicator	Average values	Difference indicator
<b>Figurative abstractness</b>	2,9		1,6		2,0		2,0	
<b>Symbolic abstractness</b>	1,6		1,9		2,0		1,6	
<b>imagery</b>	3,4	16,64**	2,1	14,68**	2,7	5,95	2,1	4,43
<b>Symbolism</b>	2,2		3,1		3,0		2,1	

Note: \*\*\* $p \leq 0,001$ ; \*\* $p \leq 0,01$ ; \* $p \leq 0,05$ .

According to the presented data, significant differences established using the Friedman chi-square test were found between the indicators of cognitive maps that were performed based on the results of solving the first ( $\chi^2_{r emp.} = 16.64$ ;  $p \leq 0.01$ ) and the second task ( $\chi^2_{r emp.} = 14.68$ ;  $p \leq 0.01$ ). Among the indicators of cognitive maps performed at the end of the first task, imagery is predominant (3,4). At the same time, high values for figurative abstractness (2.9) indicate the predominance of abstract images in maps that are based on nonverbal tasks, with one possible solution. The indicators of symbolism (2,2) and symbolic abstractness (1,6), on the contrary, are relatively small. In addition, the low values of symbolic abstractness indicate the predominance of the nonverbal component of the cognitive map over the verbal one, in such maps, there are many specific concepts and few generalizations. The indicators of cognitive maps performed on the results of the second task demonstrate the predominance of symbolism (3,1) over imagery (2,1). Indicators of abstractness of both symbolic (1,9) and figurative (1,6) are at a low level. These cognitive maps are dominated by verbal objects – verbal descriptions that are specific in nature. The nonverbal component is noticeably weaker, the images themselves are concrete and inferior in abstraction to the symbolic component.

Consider the results of the second group of subjects who, according to the study conditions, had to create cognitive maps with time constraints. The results are presented in Table 3.

**Table 3**

*Differences in each individual indicator of cognitive maps performed under time constraints, based on the results of solving all types of tasks*

Types of tasks	Indicators of cognitive maps							
	Figurative abstractness		Symbolic abstractness		imagery		Symbolism	
	Average values	Difference indicator	Average values	Difference indicator	Average values	Difference indicator	Average values	Difference indicator
Task 1 Nonverbal, with one solution option	3,3		1,8		3,5		2,6	
Task 2 Verbal, with multiple solutions	1,6		2,8		2,0		2,1	
Task 3 Nonverbal, with multiple solutions	2,9	16,03**	1,7	11,31*	2,3	19,80**	1,6	7,82*
Task 4 Verbal, with one solution option	2,2		2,5		1,5		1,7	

Note: \*\*\* $p \leq 0,001$ ; \*\* $p \leq 0,01$ ; \* $p \leq 0,05$ .

In the second group of subjects, significant differences obtained using the Kruskal-Wallis H-test were found among all four indicators of cognitive maps: figurative abstractness (hemp.=16.03;  $p \leq 0.01$ ), symbolic abstractness (hemp.=11,31;  $p \leq 0,05$ ), imagery (hemp.=19.80;  $p \leq 0.01$ ) and symbolism (hemp.=7,82;  $p \leq 0,05$ ). The highest indicators of figurative abstractness (3.3), figurativeness (3.5) and symbolism (2.6) are demonstrated by cognitive maps based on the results of the first type of tasks – nonverbal, with one possible solution. The highest indicators of symbolic abstraction (2.8) were demonstrated by the subjects, creating cognitive maps, based on the results of solving the second type of problem – verbal, with several possible solutions.

The indicators of the figurative abstractness of the cognitive maps performed on the results of nonverbal tasks significantly exceed the indicators of verbal tasks. Cognitive maps based on problems with multiple solutions are inferior in this indicator to problems with a single solution. At the same time, the largest gap in the index of figurative abstractness is observed between cognitive maps created on the basis of verbal and nonverbal tasks.

High symbolic abstractness, on the contrary, is typical for verbal tasks. However, the results in terms of symbolic abstractness are slightly higher for cognitive maps based on the results of solving problems with multiple solutions.

The high rate of imagery that the cognitive map demonstrates is based on a nonverbal task with one solution option, which is not typical for other types of tasks. Cognitive maps based on the third task, despite its nonverbal nature, show a significant decrease in the indicators of imagery, but at the same time, according to these indicators, they are superior to cognitive maps made on the basis of verbal tasks.

A higher symbolism is observed in a map that displays a nonverbal problem with one solution, compared to maps made on the basis of verbal problems with several solutions. However, for verbal tasks, the opposite picture is observed. Cognitive maps based on such tasks show high rates of symbolism in the case of several solutions to it.

Now we shall look at the data on the differences between all the indicators of the cognitive maps performed based on the results of solving each individual type of tasks, with time constraints. The results are presented in table 4.

**Table 4**

*Differences between all indicators of cognitive maps performed under time constraints, based on the results of solving each individual type of task*

Indicators of cognitive maps	Types of tasks							
	Task 1		Task 2		Task 3		Task 4	
	Nonverbal, with one solution option		Verbal, with multiple solutions		Nonverbal, with multiple solutions		Verbal, with one solution option	
	Average values	Difference indicator	Average values	Difference indicator	Average values	Difference indicator	Average values	Difference indicator
<b>Figurative abstractness</b>	3,3		1,6		2,9		2,2	
<b>Symbolic abstractness</b>	1,8	16,64**	2,8	14,68**	1,7	5,95	2,5	4,43
<b>imagery</b>	3,5		2,0		2,3		1,5	
<b>Symbolism</b>	2,6		2,1		1,6		1,7	

Note: \*\*\* $p \leq 0,001$ ; \*\* $p \leq 0,01$ ; \* $p \leq 0,05$ .

According to the presented data, significant differences established using the Friedman chi-square test were found between the indicators of cognitive maps that were performed based on the results of solving the first ( $\chi^2_{\text{emp.}}=15.519$ ;  $p \leq 0.01$ ), the second ( $\chi^2_{\text{emp.}}=7.82$ ;  $p \leq 0.05$ ), the third ( $\chi^2_{\text{emp.}}=10.03$ ;  $p \leq 0.05$ ) and the fourth ( $\chi^2_{\text{emp.}}=8.45$ ;  $p \leq 0.05$ ) tasks.

The cognitive maps that were completed on the results of the first task are expected to have the highest values of imagery (3.5) and figurative abstractness (3.3). In such maps, the main information is represented by nonverbal objects of a high level of abstraction, the verbal component is represented to a less extent (2.6), and its abstractness is relatively low (1.8). Among the cognitive maps completed as a result of the second task, the symbolism (2.1), representing the verbal component, only slightly exceeds the imagery (2.0) as a verbal component of the maps. However, symbolic abstractness (2.8) is significantly ahead of figurative abstractness (1.6). In these maps, the verbal and nonverbal components are represented quantitatively in almost equal proportions, but qualitatively differ significantly, using mainly abstract concepts, against the background of specific images. The indicators of cognitive maps performed on the results of the third task demonstrate the predominance of imagery (2.3), over symbolism (1.6) and figurative abstraction (2.9), over symbolic abstraction (1.7). In such maps, the verbal component has a fairly significant predominance over the nonverbal component, with a significant abstraction of images and concreteness of the concepts used. The cognitive maps performed on the results of the fourth task demonstrate the predominance of symbolism (1.7) over imagery (1.5) and symbolic abstraction (2.5), over figurative abstraction (2.2). In these maps, the predominance of the verbal component over the nonverbal one is pronounced weak, and the degree of abstractness of the concepts used is relatively high, with average indicators of the abstractness of images.

The results of the study of the first and second groups of subjects allow us to compare the indicators of the cognitive maps performed in each of them, in order to find differences between them. The calculation of the Mann-Whitney U-test showed the following statistically significant differences between the groups in terms of cognitive maps: between the indicators of figurative abstractness in solving the third Uemp problem. =21.5;  $p \leq 0.05$ ; between the indicators of symbolic abstractness in solving the second Uemp problem.= 20.0;  $p \leq 0.05$ ; between the indicators of symbolic abstractness in solving the fourth Uemp problem.=21.5;  $p \leq 0.05$ ; between the indicators of imagery in solving the fourth Uemp problem.=25.5;  $p \leq 0.05$ ; between the symbolism indicators when solving the second Uemp problem.=16.5,  $p \leq 0.01$ ; between the symbolism indicators when solving the third Uemp problem. =11.0;  $p \leq 0.01$ ;

## Discussions

It can be assumed that working with a nonverbal task with one correct solution and no time limits was perceived by the participants of the collaborative thinking activity primarily at the nonverbal level. This was evidenced by the high rates of imagery and significantly lower rates of symbolism of cognitive maps. At the same time, the images used in the thought process were of a generalizing, abstract nature. This is evident in the high levels of figurative abstractness of cognitive maps. The indicators of symbolic abstractness, on the contrary, are quite low. Consequently, in the process of solving this type of problem, the verbal component of thinking was concrete, describing the immediate moments of the thought process. This seems to be due to the auxiliary role played by the verbal component of thinking in this case. Abstract images made it possible to work with a large number of ideas that arose in the process of solving the first problem, without having to translate them into verbal form. According to research of S. Deana, when working with information flows, the unconscious translates nonverbal images into conscious, which are realized by the person as necessary (Dehaene, 2011; Dehaene et al., 2014). Due to the nonverbal nature of the task being solved, the translation of a significant part of the information into verbal form was unnecessary. The presence of a certain number of specific words, reflected the final moment of thinking. When the participants of the discussion shared their already formed idea with each other.

Working with a verbal task that has one correct solution and no time limit demonstrates a slightly different picture of thinking activity. According to the low indicators of figurative and symbolic abstractness, the thought process of solving the fourth problem was more concrete than the first one. Apparently, the solution of this problem, almost equally involved both the verbal and nonverbal components of the psyche, which can also be seen in the average indicators of imagery and symbolism. When comparing different options for possible solutions to a problem where only one method is correct, finding such a method requires significant time and effort. Indeed, finding one of the many correct solutions to a problem is statistically easier than finding a single solution. When finding the only correct solution, you need to go through and analyze more options than when finding one of several correct solutions. Apparently, therefore, the problem of speed comes to the fore of thinking activity. In this case, the problem of the speed of thinking was solved by shifting the thinking activity towards the nonverbal unconscious component, as shown in the research of A. Dijksterhuis (Dijksterhuis and Nordgre, 2006). However, the verbal nature of the task prevented them from fully switching to image manipulation, and their thinking activity was forced to balance between their verbal and nonverbal components.

When working with a verbal and nonverbal task that has several solutions, the verbal component of thinking, in the subjects, clearly prevails over the nonverbal, which is noticeable by the increased indicators of the symbolism of cognitive maps. At the same time, figurative abstractness increased when solving nonverbal tasks, while symbolic abstractness remained at an average level. It did not differ much in the cognitive maps drawn from the results of verbal and nonverbal tasks. This seems to be a reflection of the freer, more creative nature of thinking activity in this case. The subjects had to make a choice between several possible solutions, some of which had obvious signs of the correct solution. In such circumstances, it may be necessary to consciously pay attention to the details of possible solutions, pronouncing them for yourself and others, which increases the verbal component of thinking. The results obtained are in many respects similar to the data of the experiments of A. Dijksterhuis and H. Aarts (Dijksterhuis and Aarts 2010). Although these researchers claimed that it is the unconscious that is better suited to solve creative problems, they did not deny that with alternative solutions, the conscious component of the psyche may be more effective. Participants could pay more attention to the discussion of various ideas, compare several correct solutions among themselves, find the best alternative by such a comparison; at the same time, being not limited to strict requirements for the result of the decision. Taking into account the activating function of positive gnostic emotions, which are typical in this case, this approach allowed us to talk more about possible ways to achieve results, express original ideas more freely, and concretize them at the verbal level (Belousova and Belousova, 2020). The increase in the index of nonverbal abstractness in nonverbal tasks can be explained by the need to reflect the nonverbal component of the task, which is of a secondary nature in the verbal task.

The thinking features demonstrated by the subjects when working on a nonverbal problem with one solution that has time constraints are generally similar to the thinking features of the subjects when solving the same problem that does not have time constraints. The reduced use of words in general and abstract concepts in particular seems to have reduced the time needed to formulate them, as it did when solving problems in groups without time constraints. However, these indicators were higher in groups with time constraints. Due to this, it became possible to increase the value of the nonverbal component of thinking. It can be assumed that it was the temporary pressure on the groups that led to

these features of the manifestation of thought processes. The data obtained correspond to the results of a series of experiments by M. Strick, L. F. Nordgren and R. B. van Baaren, which confirm the idea that the unconscious is able to perform more mental operations than conscious, thereby accelerating thought processes (Strick et al., 2011). This strengthening of the cognitive unconscious contributed to an increase in the share of images and abstract concepts in thinking and made it difficult to translate them into a verbal, fully conscious form in the future.

When working with a nonverbal task that has several solutions with a time limit, the subjects' thinking shows a decrease in imagery, compared to solving a problem with one solution, but exceeds this indicator when solving verbal tasks. This suggests that the presence of several options for solving the problem, with its nonverbal nature, reduced the overall intensity of thinking activity. The relative ease of finding one of several solutions, compared to the need to find the only correct solution, and the nonverbal nature of the task itself, which made it difficult to exchange opinions in a group, made the picture of thinking less rich in images and concepts.

The relatively high symbolic thinking of the subjects who worked on a verbal problem with multiple solutions and time constraints, compared to the maps made on the basis of a problem with a single solution, indicates a reliance on verbal mental processes, with their ability to abstract and generalize. However, due to the relative slowness of the verbal manifestations of thought processes, the use of images gives an advantage in speed. According to the theory of the global workspace of B. Baars, thought processes individually work unconsciously (Baars, 2017). However, in order to form a general picture of what is happening, their interaction becomes conscious. In this case, the need to work on different alternatives to solving the problem under time constraints led to the need to simultaneously quickly search for different solutions (using the nonverbal, unconscious component of thinking) and simultaneously integrate the results of these solutions into the overall thought process (using the verbal, conscious component of thinking). This in turn increases the abstractness of symbolic thinking and makes the differences between the indicators of symbolic and figurative abstractness based on verbal tasks more significant than the differences in the indicators of figurative and symbolic thinking.

The differences between the indicators of thought processes implemented without time constraints (the first group) and thought processes implemented with time constraints (the second group) indicate the pressure of the time factor that the thinking of the subjects from the second group experienced. They are more likely than the subjects of the first group to use abstract images and concepts in their thought processes, but in general they use symbols and images in a less balanced way, which is why, as a rule, there is a clear predominance of either one or the other in their thinking. Subjects from the first group are more inclined to use specific words and images in their thought processes, tend to build complex structures, and prefer to adhere to approximately equal use of the verbal and nonverbal components in their thought processes.

## Conclusions

The results obtained in the study make it possible to see the direct interaction of verbal and nonverbal components of thought processes and indirectly observe the dynamics of relations between the conscious and unconscious components of the psyche.

Based on the data obtained, the following conclusions can be drawn:

1. Under the conditions of time constraints, the tendency to use abstract images in thinking activity increases significantly, when the conscious, not having time to formulate thoughts clearly enough in a verbal-logical form and subject them to verbal processing, gives way to the unconscious, which processes information on a nonverbal level and is able to give the necessary description on the basis of unclear, generalized images.

2. When solving nonverbal tasks with time constraints, the use of abstract concepts increases, while in the absence of time pressure, the use of abstract concepts is inferior to the use of abstract images. In the conditions of lack of time, the differentiation of the implementation of verbal and nonverbal processes in thinking activity increases due to the difficulties of double encoding, when the verbal component of thought processes ceases to have time to decipher the nonverbal images generated by the unconscious component of the psyche, and is forced to separate from it.

3. The symbolism of thinking processes in solving verbal problems with multiple solutions is higher than in such problems with a single solution. A large number of solutions to these problems increases the activity of the verbal component of thinking. When solving a nonverbal problem with one correct answer, on the contrary, the imagery of thinking activity in the psyche is higher than when solving a nonverbal

problem with multiple solutions, which can be explained by the ability of the nonverbal component of thinking to unconsciously conduct a quick search of solutions. Therefore, when thinking about a large number of alternatives with the help of verbal and logical thinking, a person is aware of and, consequently, displays a lot of objects of his thinking activity, which increases the symbolic component of his/her ideas about it. On the contrary, when working with nonverbal elements, imaginative thinking is involved in the analysis of many alternatives, most of them he/she simply does not realize and only when working with one solution, even in a nonverbal form, enough objects are displayed in the psyche to give a fairly complete description of the imaginative thought processes.

4. The figurative component of thinking, prevails over the symbolic, in thinking activity, when solving both verbal and nonverbal tasks. At the same time, the imagery of thought processes when solving problems with one answer is higher than with many, and when solving nonverbal problems, it is higher than verbal ones. This is due to the fact that thinking activity relies on the language of images, which are then translated into verbal representations.

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### Conflict of interests

The author declares no conflict of interest.

## References

- Baars, B. J. (2017). The Blackwell Companion to Consciousness. In Schneider S, & Velmans M (Eds), *The global workspace theory of consciousness: Predictions and results* (2 ed., Pp. 227-242). West Sussex, Chichester: John Wiley & Sons Ltd. ISBN: 9780470674062. <https://doi.org/10.1002/9781119132363>
- Beel, J., & Langer, S. (2011). An exploratory analysis of mind maps. [Abstract]. In *Proceedings of the 11th ACM symposium on Document engineering*, 81-84. <https://doi.org/10.1145/2034691.2034709>
- Behrens, T. E., Muller, T. H., Whittington, J. C., Mark, S., Baram, A. B., Stachenfeld, K. L. et al. (2018). What is a cognitive map? Organizing knowledge for flexible behavior. *Neuron*, 100(2), 490-509. <https://doi.org/10.1016/j.neuron.2018.10.002>
- Bellmund, J. L., Gärdenfors, P., Moser, E. I., & Doeller, C. F. (2018). Navigating cognition: Spatial codes for human thinking. *Science*, 362(6415), 6766. <https://doi.org/10.1126/science.aat6766>
- Belousova, A., & Belousova, E. (2020). Gnostic emotions of students in solving of thinking tasks. *International Journal of Cognitive Research in Science, Engineering and Education*, 8(2), 27-34. <https://doi.org/10.5937/IJCRSEE2002027B>
- Bottini, R., & Doeller, C. F. (2020). Knowledge across reference frames: cognitive maps and image spaces. *Trends in Cognitive Sciences*. 24(8), 606-619. <https://doi.org/10.1016/j.tics.2020.05.008>
- Cañas, A. J., Novak, J. D., & Reiska, P. (2015). How good is my concept map? Am I a good Cmapper?. *Knowledge Management & E-Learning: An International Journal*, 7(1), 6-19. <https://doi.org/10.34105/j.kmel.2015.07.002>
- Dehaene, S. (2011) Conscious and Nonconscious Processes: Distinct Forms of Evidence Accumulation? In Duplantier B, & Rivasseau V (Eds), *Biological Physics*, (Pp. 141-168). Basel-Stadt, Basel: Springer. ISBN: 978-3-0346-0428-4. [https://doi.org/10.1007/978-3-0346-0428-4\\_7](https://doi.org/10.1007/978-3-0346-0428-4_7)
- Dehaene, S., Charles, L., King, J. R., & Marti, S. (2014). Toward a computational theory of conscious processing. *Current opinion in neurobiology*, 25, 76-84. <https://doi.org/10.1016/j.conb.2013.12.005>
- Dijksterhuis, A., & Aarts, H. (2010). Goals, attention, and (un) consciousness. *Annual review of psychology*, 61, 467-490. <https://doi.org/10.1146/annurev.psych.093008.100445>
- Dijksterhuis, A., & Nordgren, L. F. (2006). A theory of unconscious thought. *Perspectives on Psychological science*, 1(2), 95-109. <https://doi.org/10.1111/j.1745-6916.2006.00007.x>
- Downs, R. M., & Stea, D. (2017). Cognitive Maps and Spatial Behavior: [Electronic version]. In Downs, RM., & Stea, D (Eds), *Process and Products Image and environment: Cognitive mapping and spatial behavior*. (2 ed., Pp. 8-27). New York, NY: Transaction Publishers. (Original work published 1973) <https://doi.org/10.4324/9780203789155>
- Eden, C. (2004). Analyzing cognitive maps to help structure issues or problems. *European Journal of Operational Research*, 159(3), 673-686. [https://doi.org/10.1016/S0377-2217\(03\)00431-4](https://doi.org/10.1016/S0377-2217(03)00431-4)
- Epstein, S. (2012). Cognitive-experiential self-theory: An integrative theory of personality. In Millon T, & Lerner MJ (Eds), *Handbook of psychology: Personality and social psychology Vol. 5*. (2 ed., Pp. 159-185). New Jersey, Hoboken: John Wiley & Sons. <https://doi.org/10.1002/9781118133880.hop205005>
- Fauconnier, G. (2018). In *Ten Lectures on Cognitive Construction of Meaning*. South Holland, Leiden: Brill, 1-23. [https://doi.org/10.1163/9789004360716\\_002](https://doi.org/10.1163/9789004360716_002)
- Filomena, G., Versteegen, J. A., & Manley, E. (2019). A computational approach to 'The Image of the City'. *Cities*, 89, 14-25. <https://doi.org/10.1016/j.cities.2019.01.006>
- McAleese, R. (1998). The knowledge arena as an extension to the concept map: Reflection in action. *Interactive Learning Environments*, 6(3), 251-272. <https://doi.org/10.1076/ilee.6.3.251.3602>

- Milgram, S. (1970). The experience of living in cities. [Electronic version]. *Science*, 167(3924), 1461-1468. <https://doi.org/10.1126/science.167.3924.1461>
- Nanay, B. (2021). Unconscious mental imagery. *Philosophical Transactions of the Royal Society B*, 376(1817), 20190689. <https://doi.org/10.1098/rstb.2019.0689>
- Nesbit, J. C., & Adesope, O. O. (2006). Learning with concept and knowledge maps: A meta-analysis. *Review of educational research*, 76(3), 413-448. <https://doi.org/10.3102/00346543076003413>
- Novak, J. (2010). Learning, Creating, and Using Knowledge: Concept maps as facilitative tools in schools and corporations. *Journal of e-Learning and Knowledge Society*, 6(3), 21-30. Retrieved from <https://www.learnit.echlib.org/p/43512/>
- Paivio, A. (2011). Dual coding theory, word abstractness, and emotion: A critical review of Kousta et al. *Journal of Experimental Psychology: General*, 142(1), 282-287. <https://doi.org/10.1037/a0027004>
- Palmiero, M., Piccardi, L., Giancola, M., Nori, R., D'Amico, S., & Belardinelli, M. O. (2019). The format of mental imagery: from a critical review to an integrated embodied representation approach. *Cognitive processing*, 20(3), 277-289. <https://doi.org/10.1007/s10339-019-00908-z>
- Park, S. A., Miller, D. S., Nili, H., Ranganath, C., & Boorman, E. D. (2020). Map making: constructing, combining, and inferring on abstract cognitive maps. *Neuron*, 107(6), 1226-1238. <https://doi.org/10.1016/j.neuron.2020.06.030>
- Rosch, E. H. (2011). Slow lettuce: Categories, concepts, fuzzy sets, and logical deduction. [Electronic version]. In Belohlavek, R. & Klir, GJ (Eds), *Concepts and fuzzy logic*, (Pp. 89-120). Massachusetts, Cambridge: MIT Press. Retrieved from [https://www.researchgate.net/publication/221705062\\_6\\_Representing\\_Concepts\\_by\\_Fuzzy\\_Sets](https://www.researchgate.net/publication/221705062_6_Representing_Concepts_by_Fuzzy_Sets)
- Sadoski, M., & Paivio, A. (2013). *Imagery and text: A dual coding theory of reading and writing*. New York, NY: Routledge. <https://doi.org/10.4324/9780203801932>
- Solso, R. L., MacLin, O. H., & MacLin, M. K. (2014). *Cognitive Psychology: Pearson New International Edition*. Essex, Harlow: Pearson. Retrieved from <https://ru.scribd.com/document/436463162/Solso-Robert-L-Cognitive-Psychology-Pearson-2013-KOGNITIF-pdf>
- Stern, D. B. (2015). *Relational freedom: Emergent properties of the interpersonal field*. New York, NY: Routledge. ISBN: 9781315765570. <https://doi.org/10.4324/9781315765570>
- Strick, M., Dijksterhuis, A., Bos, M. W., Sjoerdsma, A., Van Baaren, R. B., & Nordgren, L. F. (2011). A meta-analysis on unconscious thought effects. *Social Cognition*, 29(6), 738-762. <https://doi.org/10.1521/soco.2011.29.6.738>
- Sweller, J. (2020). Cognitive load theory and educational technology. *Educational Technology Research and Development*, 68(1), 1-16. <https://doi.org/10.1007/s11423-019-09701-3>
- Tolman, E. C. (1948). Cognitive maps in rats and men. *Psychological review*, 55(4), 189. <https://doi.org/10.1037/h0061626>
- Ward, T. B., Finke, R. A., & Smith, S. M. (2013). *Creativity and the mind: Discovering the genius within*. Massachusetts, Boston: Springer. (Original work published 1995) ISBN: 978-1-4899-3330-0 <https://doi.org/10.1007/978-1-4899-3330-0>

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# Students' Perception and Attitudes toward Faculty Image on Social Networks

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**Abstract:** Purpose of this paper is to determine how students perceive the image of their faculty on social networks, but also to analyse their experience and attitudes towards faculty social media strategy. The research was implemented using descriptive statistic techniques, as well as non-parametric tests such as Mann-Whitney U Test, Kruskal-Wallis H Test and Spearman's Rho. The most common source of information when it comes to enrolment to faculty is word of mouth, while social media have a significantly lower credibility. During their schooling the respondents have most confidence in the official website, and far less in social networks. Such findings signalize the necessity of creating an adequate digital marketing strategy that can significantly improve the perceived faculty image. Positive perception of the image is fundamental for understanding the process of searching for and selection of the faculty, especially since the results have shown that the students do not value highly the image their faculties have on social networks. Positive perception of faculty image mostly depends on promotion strategy on Facebook and Instagram, and far less on LinkedIn and Twitter. In addition, students value more the image of the faculty whose social network profile they follow and, in a case, when they are followed back. No correlation was found between faculty image and gender, age or average grade. Therefore, we can conclude that social networks are very important in creating positive image and thanks to new technology, they are a promising solution for differentiation from competition in digital space.

*Keywords:* student's perception, attitudes, faculty image, social networks, tourism and hospitality faculty.

## Introduction

Over the last few years, the higher education sector has experienced accelerated market changes, which has led to the development of numerous customer-driven marketing strategies as well as recruitment processes. These changes primarily occur thanks to the millennial generation, who know and use the internet very well (Hesel and Williams, 2009) demonstrating a strong need and desire to connect with other people and cooperate with them (Lindbeck and Fodrey, 2010). Smith (2011) as well as Milićević, Petrović, and Đorđević, (2020) state that the competitiveness of higher education institution should derive from the opportunities students have to access all the information they need very quickly and easily.

Kaplan and Mazurek (2018) define social media as a group of Internet-based applications that allow the users to exchange the content and to participate in interactive communication. Social media provide a very easy way for organizations to connect with the existing and future clients, as well as other interested stakeholders (Nyangau and Bado, 2012; Minocha, 2009). Social media are especially important marketing tools for higher education institutions (HEI) (Constantinides and Zinck Stagno, 2011). Higher education institutions mostly use the following social media: social networks (such as Facebook and Instagram), web platforms for online video sharing (such as YouTube and Snapchat), blogs (like Twitter), business-oriented online services (such as LinkedIn), Internet forums, etc. (Mazurek, Korzyński and Górska, 2019). In particular social media are becoming very important for students (Tezer, et al., 2017). Eldegwy, Elsharnouby and Kortam (2018) state that social media enable interactive communication between students, as well as between the students and the employees of higher education institutions, which overall contributes to

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their positive experience during studies. For example, existing university students share information and their experiences about studying in social media platforms, which may contribute significantly to new students (De Silva and Rossi, 2018). Facebook is the example of the social network that is most accepted by students as it provides them with easy and fast communication with the higher education institution (Roblyer et al., 2010).

Numerous authors define the organizational image in different ways. According to Küçüksüleymanoğlu (2015) organizational image is the sum of thoughts and perceptions created in the minds of key stakeholders about the organization and its constitutive elements. Organizational image refers to people's impressions of an organization and is defined as people's loose structures of knowledge and beliefs about an organization (Lievens, 2017). Van Riel and Fombrun (2007) state that organizational image comprises of all the interpretations the stakeholders make about an organization. Image is an immediate stakeholder perception founded on impressions toward the organization (Heding et al., 2009; Huang and Lien, 2012). In general, the definitions of organizational image take into consideration a cognitive element based on the group of perceived beliefs or attributes of the organization (Pérez and Torres, 2017).

In scientific publications, one can find research by numerous authors regarding the organizational image of higher education institutions. Organizational image of a higher education institution is a perceived image that the public has toward the institution according to their interests and personal experiences (Nguyen and LeBlanc, 2001). Organizational image is an important issue for many higher education institutions due to the competitive environment that conditions a significantly higher level of service quality (Pérez and Torres, 2017). It is an important factor to attract and retain the best domestic and foreign students and prestigious professors (Drydakis, 2015; Faham et al., 2017; Kheiry et al., 2012; Polat, 2011). In other words, the institutional image has a direct impact on students' value perception, satisfaction and loyalty and it is a very important tool to attract new students (Brown and Mazzarol, 2009; Elsharnouby, 2015).

To create a successful image of a higher education institution, it is very important to consult the key stakeholders, and accordingly choose the most appropriate communication strategy (Küçüksüleymanoğlu, 2015). Numerous authors in their research have analyzed relationships among student's perception and image of higher education institutions (Alves and Raposo, 2010; Pampaloni, 2010; Sung and Yang, 2008). Küçüksüleymanoğlu (2015) states that the students' perceptions of the image of the faculty depend on their gender, their socio-cultural activities and their achievements during studies. The results of the research conducted at Australian universities show that the image of the faculty is of great importance for the students, regardless of the students' age (Brown and Mazzarol, 2009).

Institutional image is usually created as the result of the interplay between two elements, as an integration of the information presented by the higher education institution and the communication instruments (Mackelo and Drūteikienė, 2010). Some researchers indicate that the organizational image of a higher education institution consists of a great number of factors, such as: previous reputation, facilities, courses popularity, atmosphere, tuition fees, professors, theoretical–practical approach, communication between students and professors, number of students and marketing efforts in the online environment (Fransen and Van Rompay, 2011; Galinienė et al. 2009; Štefko et al., 2015).

According to Simoes and Soares (2010) the Internet has significantly changed the way students obtain information about higher education institutions. Communication becomes more virtual, digital, online, but its purpose remains the same (Garabinović, 2019). Online environment offers higher education institutions various marketing strategies that facilitate the placement of a lot of information and enable two-way communication with the existing and future students (Alexa, Alexa, and Stoica, 2012). A well-designed institution's website leads to a positive perception toward the higher education institution, i.e., becomes a dynamic marketing tool to attract students (Foroudi et al., 2019).

The main objective of the study is to determine students' perception towards the image of the faculty on social networks. Also, this paper examined their attitudes and experience regarding faculty social media strategy. Beside this, in the research focus, is impact of social networks on recruiting new students and comparison of faculty usage of traditional communication with a communication through social network.

## Literature review

In the last few years higher education (both vocational and academic ones) has become one of the fastest-growing service sectors (Alwi and Kitchen, 2014) which has contributed to the spread of knowledge and the development of society (Council of Europe, 2019). This trend is followed by more usage of social networks for reaching out new students as well as by dominating digital marketing strategies

over traditional ones (Bamberger, Bronshtein, and Yemini, 2020). Benefits that these networks offer are numerous. First of all, lower expenditures of promotion, high effectiveness in communication and reaching audience, institution comparison based on their online image, a large number of users, interactivity, adaptiveness and availability (Bednar, 2013; Kelleher and Sweetser, 2012; Kumar and Nanda, 2019; Kumar and Nanda, 2020; Manca and Ranieri, 2016). Social networks made new relationships with future and existing students, throughout fostering their engagements through likes, comments, and shares of a post (Bamberger, Bronshtein and Yemini, 2020; Brech et al. 2017; Kelly, Kerr, and Drennan, 2010; Pucciarelli and Kaplan, 2016). Designing scalable learning system based on student preferences is the future of HEI's (Kuzmanovic et al. 2019).

Barnes and Matson (2010) investigated usage of social media in U.S. higher education and they found that the most popular is Facebook, which they use for attracting students, while Twitter was on the second place. Slover-Linett and Stoner (2011) analysed data collected from 1,000 universities worldwide, and concluded that most institutions used Facebook (94%), on the second place were Twitter, LinkedIn, and/or YouTube. Kuzma and Wright (2013) explored usage of social networks among 90 universities in Africa, Asia and Europe, where results indicate Facebook and LinkedIn are the most represented in all locations, especially Facebook with 77% to 94% usage for marketing purpose, while others (Twitter, MySpace and YouTube) vary in different countries. Most of the universities are using predominantly global social networks except in China, where the market is dominated by local ones. Beside growing number of networks, Peruta and Shields (2018), consider that Facebook is still the most powerful tool that can provide significant return on HE marketing investment through user generated content posted at right time. Research study of state faculties in Serbia and their visibility on social media has shown that they do not have clear social media strategy and that Facebook is the most often used channel (Stević, Vujičić, and Lalić, 2017). The latest investigation of Serbian HEI, has also shown the lack of usage of LinkedIn and Twitter, which may indicate that not all faculties have accounts on these networks (Vukić and Vukić, 2019).

Beside their primary function such as communication, social networks can be a very powerful tool for teaching and learning purposes (Dyson et al., 2015; Ivanović et al., 2018; Kumar and Nanda, 2020; Radovanović, Hogan, and Lalić, 2015; Tess, 2013). In this respect, they foster creativity, discussions, peer learning, new learning experience, constructive feedback (Kumar and Nanda, 2020) and play a vital role in lifelong learning (Duggan et al., 2015). Social networks throughout digital lecture provide opportunities of unlimited access to extensive resources of knowledge (Powers et al., 2012), development of distance learning and open educational resources (McDougall, Readman, and Wilkinson, 2012). This way of interaction, allows students to feel more connected with university and their colleagues, with tendency to become alumni who will create a strong ecosystem.

Quality HEI's services have a positive impact on students' satisfaction, which will affect their profitability (Duque, 2014). Therefore, it is very important to create an adequate brand image on social networks that will reflect all values that they offer. Furthermore, with an adequate image, it is much easier to attract international students and key stakeholders (Pucciarelli and Kaplan, 2016). This conclusion complements Merrill (2011) who states that the use of social networks improves promotion of institution, distribution of information, recognition of their brand, engagement of potential students, and valuable metrics and competitor practices. An adequate promotion of university brand on social networks can positively affect students' decision-making process (Huynh and Nguyen, 2015) and also determine identities of all stakeholders such as prospective students, current students, graduates, and companies (Lafuente Ruiz de Sabando, Forcada Sainz, and Zorrilla Calvo, 2018). It is very important that students actively participate in the value creation process for brand image and reputation, as they have a more positive attitude toward the university and are more satisfied with their customer journey which brings more attachment to the university (Foroudi et al., 2019). Study conducted by Vogler (2020) shows that despite the crisis in journalism, news media provide credible knowledge and social media represent trustable sources for independent information about science.

We can retrieve few conclusions from previous literature review. Most of the researches have focused on aspects such as: learning and teaching possibilities through social networks; social media strategies, university brand image on social media and students' satisfaction. Moreover, it can be concluded that HEIs marketing and recruiting strategy cannot be imagined without social networks, especially Facebook, which is the most popular among students from all over the world. In addition to promotion, social networks enhance university prestige and status, which particularly affects international students, whose attraction can increase profitability. However, the main conclusion is, that there is lack of knowledge about how HEI's image on social media affects students' interest for enrolment, and authors found no previous research study regarding students' perception of HEI image on social networks in Serbia. Therefore, the results of this study provide a better insight into what affects the perception of the

image of the faculty on social networks and it can be used for making the image of the faculty better.

## Materials and Methods

An empirical study was conducted to explore the students' perception of faculty image on social networks, as well as their experience and attitudes toward faculty social media strategy. The study sample consisted of students who studied hotel management and tourism courses at the University of Belgrade and the University of Novi Sad, which included four faculties. The main research instrument in this study was an online questionnaire, which was distributed through faculties' Facebook groups during summer semester of the 2019/20 academic year.

The questionnaire was organized in three sections. The first section covered questions related to the demographics of the respondents. The second section was related to their experience and attitudes towards the faculty social media strategy. Statements regarding students' perceptions of the faculty image on social networks were included in the third section. Students evaluated statements on a five-point Likert scale, where 1 stands for "strongly disagree", while 5 stands for "strongly agree". The research plan was adopted from the previous study of the impact of social networks on the recruitment of college students conducted by Vukić and Vukić (2019), but this study provides more detailed insight into the significance of social networks for creating positive image of HEI.

Quantitative research methods were applied and data analysis was done using IBM SPSS 25.0 for Windows software. Descriptive statistics was used for computing mean and standard deviation of all items. Mann-Whitney U Test was used, in order to test the equality of Mean Rank in two independent samples. Spearman's Rho was used in order to measure the strength of correlation between two variables that did not have a normal distribution. Kruskal-Wallis H Test was applied. In order to obtain statistically significant evidence, that there is a difference in Mean Rank between more than two groups of independent variables. Chrombach Alpha reliability test was used to check the internal consistency of the statements used for measuring summed scale of perception. These non-parametric analyses were conducted, because Shapiro-Wilk's test ( $p < 0.01$ ) showed that criteria for normally distributed data were not met. The results of the study should answer questions such as: 1) What are students' experience and attitudes toward faculty social media strategy; 2) What is students' perception about the image of the faculty on social networks; 3) Is there a correlation between the faculty image on social networks and attraction of new students; 4) Are there statistical differences in students' perception about the image of the faculty across their different characteristics e.g. sex, year of the study, content which they pay the most attention to when they visit a faculty's profile.

## Results and Discussion

A total of 270 students completed the questionnaire. Demographic data show that the number of female respondents was slightly higher than the number of male respondents. The average age of the respondents was 22.18 (SD = 2.27) while average grade during studies of the students from the sample was 8.17 (SD = 0.62). More detailed information about demographics of the sample is shown in Table 1.

**Table 1**  
*Sample characteristics*

	Frequency	Percent		
<b>Sex</b>				
male	132	48.9%		
female	138	51.1%		
Total	270	100%		
<b>Year of study</b>				
	Frequency	Percent		
first	30	11.1%		
second	44	16.3%		
third	66	24.4%		
forth	62	23.0%		
only exams left	32	11.9%		
graduated	36	13.3%		
Total	270	100%		
	Minimum	Maximum	Mean	Std. Deviation
Average grade	7	10	8.17	0.62
Average age	18	31	22.18	2.27

Regarding the way of obtaining information when enrolling in faculty, the students mostly made use of word-of-mouth propaganda (41.1%), followed by personal visits to the faculty (24.1%), the third source of information being their high-school teachers (13.7%), the fourth social networks (12.6%), whereas they were least informed through the visits of the faculty representatives (5.2%) or propaganda in the media (TV, radio, magazines, newspapers). Insufficient use of social networks for obtaining information could indicate that faculties' social media profiles don't give enough real time information about enrolment. Prospective students are easily bored searchers, that's why faculties will need to transition from traditional communication to content that is visually appealing and psychologically intrigues. Sharing stories could make stronger connections with the faculty, and help students in decision making process. Live features could engage current and potential customers by sharing faculty events in real-time, which can bring them a real sense of what student's life is like from a student's point of view. Good social media strategy gives new opportunities for faculties and even brought personality back into a digital world. However, all this, open research gap for additional examination of such a poor rating of social network.

The respondents think that the most important social network in terms of attracting new students is Facebook (mean = 3.84), followed by Instagram (mean= 3.64), whereas the less important are LinkedIn (mean = 2.31) and Twitter (mean = 2.16). Such a small significance of LinkedIn and Twitter may be an indicator of the infrequent use of these social networks, which should be further investigated.

The results have shown that a vast majority of students follow their faculties on social networks (81.1%) whereas only 18.9 % do not. This finding leaves plenty of opportunities for faculties in Serbia to exploit the potential of social networks and apply a new branding concept, which will positively affect their reputation and consequently make it easier for the students to differentiate between competitors. However, the faculties follow a very small number of students (24.1%); that way, the faculties are missing the information on the contents students post and the ones they react to, thus losing the most important purpose of social networks – interactivity.

Students check the faculties' social network profiles mostly in order to get informed (96.3%), very few of them for educational purposes (0.7%) and for fun 3%. Such information may indicate that other contents are posted to a lesser extent, and therefore it is important to check their preferences towards the contents they would like to see. However, in order for the faculties to have diverse content on social

networks, the faculty itself has to reshape its own business model in terms of offering new educational package that will be developed together with the students and stakeholders, creating new values.

The source of information most trusted by the students when it comes to notification during their studies is the official website (80.4%), as expected; their professors come in second (8.1%), fellow students third (7%), faculty profile on social networks fourth (2.6%), whereas other sources come in last (1.9%). This may indicate the fact that the notifications on social networks are not regularly updated, or that they are considerably late in doing so compared to the website, so it is safe to say that the faculty do not have a clear social media strategy.

As for the students' perception related to the contents on the social networks of the faculty, most of them pay the most attention to the text (68.1%), half as many to the picture (30.7%), and the least of them pay attention to the video (1.1%).

### Students' perception of faculty image on social networks

Except from the students' experience and attitudes towards the faculties' social media strategy, this study investigated students' perception of faculty image on social networks. For this purpose, a new summary scale was designed, consisting of individual items of students' attitudes towards the image on social media. The theoretical range of the scale ranges from 1 (denoting the perception that the faculty image on social networks is not satisfactorily) to 5 (image of the faculty on social networks is highly satisfactory), whereas the empirical ranges from 1.11 to 5 (Table 2). The average value of the students' responses on the summary scale is 3.12 (SD=0.82), showing that the students consider the image of the faculty on social networks not indeed satisfactory. The distribution of the students' responses in Table 3 statistically significantly deviates from normal ( $p < 0.01$ ); therefore, for the analysis of the students' perception of faculty image on social media, non-parametrical tests shall be applied (Spearman's rank correlation coefficient, Mann-Whitney and Kruskal-Wallis test). The new summary scale of faculty image on social networks indicates a satisfactory level of reliability (Cronbach's Alpha > 0.7), which can be seen in Table 2. All further analysis is conducted with summarized scale.

**Table 2**  
*Reliability of summary scale of faculty image on social networks*

	Minimum of scale	Maximum of scale	Empiric Minimum	Empiric Maximum	Mean	Std. Deviation	Cronbach's Alpha	Sig - Shapiro-Wilk
Faculty Image	1	5	1.11	5	3.12	0.82	0.84	0.03

The summary scale of the image consisted of the responses expressed through the level of agreement with the nine statements, such as: 1. quality of enrolment information on faculty social media profile is very high; 2. image of faculty on social networks can have positive impact on my employment; 3. social media profile of my faculty is interesting; 4. faculty social network profile offers high quality information about current information necessary for students; 5. social network accounts give enough information about internship opportunities; 6. social network accounts offer educational content; 7. social network accounts give detailed information about the enrolment of new candidates; 8. professors should use more social network for communication with students; 9. social networks have advantages in communication with students in comparison to traditional ways of communication.

It can be seen in Table 3 that the students expressed the highest degree of agreement with the statement that the profile of their faculty on social networks provides detailed information on the enrolment of new candidates; on the other hand, they least agreed with the statement that the communication with students through social networks should have an advantage over traditional means of communication.

**Table 3**  
*Students' attitudes towards the faculty image on social networks*

statement	means	St. dev	Min	Max
1	3.37	1.183	1	5
2	3.26	1.216	1	5
3	2.91	1.129	1	5
4	3.43	1.131	1	5
5	2.94	1.245	1	5
6	3.06	1.134	1	5
7	3.53	1.263	1	5
8	3.00	1.462	1	5
9	2.54	1.415	1	5

Spearman's rank correlation coefficient (Table 4) showed a statistically significant positive correlation between the faculty image on social networks and attracting new students through them. The more positive the image on social networks, the greater the number of students who are interested in enrolling in faculty. The positive image of the faculty on Facebook (0.44,  $p < 0.01$ ) is mostly related to attracting students, somewhat less is related with Instagram (0.33,  $p < 0.01$ ) and Twitter (0.26,  $p < 0.01$ ), and much less with LinkedIn (0.12,  $p = 0.05$ ).

**Table 4**  
*The correlation between the faculty's image, students' age, positive impact of social networks on re-cruiting new students and perception of the importance of a different social network*

		Facebook	Instagram	LinkedIn	Twitter
Faculty image	Correlation Co-efficient	<b>0.44**</b>	<b>0.33**</b>	<b>0.12*</b>	<b>0.26**</b>
	Sig. (2-tailed)	<b>0.00</b>	<b>0.00</b>	<b>0.05</b>	<b>0.00</b>
Spearman's rho Age	Correlation Co-efficient	0.02	0.02	<b>0.32**</b>	0.05
	Sig. (2-tailed)	0.77	0.81	<b>0.00</b>	0.41
Promotion on social networks have positive impact on recruiting new students	Correlation Co-efficient	<b>0.49**</b>	<b>0.31**</b>	<b>0.26**</b>	<b>0.23**</b>
	Sig. (2-tailed)	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>

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

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

Positive correlation was also found between age and perception of attracting new students via LinkedIn (0.32,  $p < 0.05$ ), i.e., older students consider LinkedIn important for attracting new students, which may indicate that these are mostly respondents who are employed, which is why they consider this network attractive. The perception of the importance of other networks for student enrolment was not related to the age of the respondents ( $p > 0.01$ ). There is a statistically significant connection between promotional activities on social networks and the attracting of new students. Namely, more intensive campaigns on Facebook (0.49,  $p < 0.01$ ) and Instagram (0.31,  $p < 0.01$ ) are associated with greater interest in enrolment, while higher promotional activities on LinkedIn (0.26,  $p < 0.01$ ) and Twitter (0.23,  $p < 0.01$ ) affect students but to a lesser extent.

Statistically significant correlation was not obtained between the faculty image and the age of respondents (0.03,  $p > 0.05$ ) and between image and the average grade (-0.04,  $p > 0.05$ ). The Average grade does not show a statistically significant correlation with the attitude that promotion on social networks positively impact recruiting students (0.01,  $p > 0.05$ ), or with the perception of the significance different

social networks (Facebook, Instagram, LinkedIn and Twitter) for recruiting new students ( $p > 0.05$ ).

Mann-Whitney U Test results confirmed statistically significant differences in the level of faculty image perception on social networks between the students who follow the faculty accounts and those who do not (3882.000,  $p < 0.01$ ), and between students who are followed by the faculty accounts and those who are not (5281.000,  $p < 0.01$ ) as shown in Table 5. Students who followed their faculty on social networks and those who are followed back, perceived faculty image more positively than the other one.

Mann-Whitney U Test indicates no significant difference in the level of expression of a positive image of the faculty on social networks, between the male and female students (9092.500,  $p > 0.05$ ). Results of Kruskal Wallis Test (8.400,  $p > 0.05$ ) suggest no significant difference in perceived image between students of different year of study (8.400,  $p > 0.05$ ) and depends on the content they pay the most attention to, when they visit a social network profile (picture, text, video) (0.765,  $p > 0.05$ ). Also, same test suggests no significant difference in perceived image depends on purpose of checking the profile of the faculty (3.836,  $p > 0.05$ ); the way they obtained information on the faculty they enrolled in (3.297,  $p > 0.05$ ) and the most trusted source they used to obtain information on the faculty (4,635,  $p > 0.05$ ).

**Table 5**

*Students' faculty image perception depending on whether they are following faculty account, and whether they are followed back on social networks*

Question	Mean rank	Mann-Whitney U	Z	Asymp. Sig. (2-tailed)
Do you follow faculty on social networks				
Yes	143.27	<b>3882.000</b>	-3.394739	<b>0.00</b>
No	102.12			
Are you followed back by faculty on social networks				
Yes	156.75	<b>5281.000</b>	-2.522	<b>0.01</b>
No	128.76			

## Conclusions

The study aimed to investigate how students perceive the image of their faculty on social networks, but also to analyse their experience and attitudes towards faculty's social media strategy. Through empirical research we gathered information which can contribute HEI in creating adequate communication strategy with prospective and current students. Also, based on results it is possible to make interactive brand, which will facilitate a students' journey towards pursuing a graduate degree. Creating content based on the students' needs it is possible to turn social networks into search engines which will answer all the necessary questions, from looking for financial costs and career opportunities, to faculty projects.

Much research has been done on usage of social networks in HEI, but most of these studies have addressed the topics such as learning and teaching possibilities, impact of HEI brand image on students' satisfaction, and decision-making process (Duque, 2014; Kuzma and Wright, 2013; Kumar and Nanda, 2020; Pucciarelli and Kaplan, 2016). Despite large scope of papers, there is lack of knowledge about how HEI's image on social media affects students' interest for enrolment.

The results of this study have shown that students primarily pay attention to the text, when it comes to HEI social network profiles. Such results can be considered logical, as the primary purpose of faculty social network profile is informative communication. However, in order to create a recognizable image, it is also important to make use of transformative communication implying the values offered to students, and therefore the institutions of higher education must carefully design various contents, as the stimuli such as text in an advertising message require more attention to be understood than a picture or a video. Due to the rapid adaptation to one type of stimuli, in order to attract the attention of current as well as potential students and other stakeholders, it is necessary to use other means of gaining attention such as colours, sounds, videos or various types of novelties, so that it could be managed. That way, it is possible to create an advertising message that contains essential information but at the same time manages to get students spend more time on social network profile of the faculty, in order to convey to them clearly the values they are offered.

When it comes to the enrolment information, research result showed that sources of the greatest

credibility are friends, acquaintances, forums, i.e., all those who are not paid to promote the college. Visits to the faculty instil great confidence during enrolment, due to the expertise i.e., professional knowledge of the professors or members of staff with whom students communicate. Social networks and media are the least likable sources in these situations, and therefore the focus should be on the development of ideas and creative strategies of communication that will help a better positioning of the faculty relative to competitors in virtual space.

Exploring the perception of the faculty's image on social networks, findings showed that the respondents think that Facebook and Instagram have the greatest influence on a positive image. This is in line with the findings of Slover-Linett and Stoner (2011) as well as Peruta and Shields (2018). Therefore, the promotional activities should be directed towards these networks. It was discovered that the perception of the faculties on social networks does not depend on the gender, year of study, the content students visited on social media profile or the way of obtaining information about enrolment.

The positive image is rather related to whether the students follow the faculty's social media profiles and whether they are followed back. This can only indicate that the students place great value on social networks i.e., that the social networks are important to them, which should be further examined.

This paper makes a number of contributions, but the most significant ones are:

- Research about students' perception and attitudes toward HEI image on social networks is extended and the body of knowledge how digital faculty brand image can attract prospective students is enriched.

- Students' perception and attitudes toward faculty social media profile were identified.

- A new social media strategy is proposed according obtained results.

This study has certain limitation. First limitation is that sample doesn't include private faculties which social media strategy could be quite different from our sample. The second limitation is the reliance on respondents who studied hotel management and tourism courses when making conclusion about the image of faculty on social networks. Also, students of higher vocational schools are not surveyed, so we can't compare their image perception with academic one. And the last one, is the fact that survey is conducted in Republic of Serbia, so the results could be specific to this territory only. Future research could focus on the collection of more diversification of respondents by their fields of education, countries and ownership structure.

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### Conflict of interests

The authors declare no conflict of interest.

## References

- Alexa, E. L., Alexa, M., & Stoica, C. M. (2012). The use of online marketing and social media in higher education institutions in Romania. *Journal of Marketing Research & Case Studies*, 2012 (1). <https://doi.org/5171/2012.721221>
- Alves, H., & Raposo, M. (2010). The influence of university image on student behaviour. *International Journal of Educational Management* 24(1): 73-85. <https://doi.org/10.1108/09513541011013060>
- Alwi, S. F. S., & Kitchen, P. J. (2014). Projecting corporate brand image and behavioral response in business schools: Cognitive or affective brand attributes?. *Journal of Business research*, 67(11), 2324-2336. <https://doi.org/10.1016/j.jbusres.2014.06.020>
- Bamberger, A., Bronshtein, Y., & Yemini, M. (2020). Marketing universities and targeting international students: a comparative analysis of social media data trails. *Teaching in Higher Education*, 25(4), 476-492. <https://doi.org/10.1080/13562517.2020.1712353>
- Barnes, N. G., & Mattson, E. (2010). Social media and college admissions: Higher-ed beats business in adoption of new tools for third year. *University of Massachusetts-Dartmouth Center for Marketing Research*. Retrieved from <http://www.umassd.edu/cmrr/>
- Bednar, J. (2013). Colleges increasingly rely on social media to interact with students and Alumni. *Business West*. Retrieved from <http://businesswest.com/blog/two-way-street/>
- Brech, F. M., Messer, U., Vander Schee, B. A., Rauschnabel, P. A., & Ivens, B. S. (2017). Engaging fans and the community in social media: Interaction with institutions of higher education on Facebook. *Journal of Marketing for Higher Education*, 27(1), 112-130. <https://doi.org/10.1080/08841241.2016.1219803>
- Brown, R. M., & Mazzarol, T. W. (2009). The importance of institutional image to student satisfaction and loyalty within higher education. *Higher education*, 58(1), 81-95. <https://doi.org/10.1007/s10734-008-9183-8>

- Constantinides, E., & Zinck Stagno, M. C. (2011). Potential of the social media as instruments of higher education marketing: A segmentation study. *Journal of marketing for higher education*, 21(1), 7-24. <https://doi.org/10.1080/08841241.2011.573593>
- Council of Europe, (2019). Retrieved December 12, 2020, from <https://www.coe.int/en/web/higher-education-and-research/european-higher-education-area>
- Council of the European Union. (2019). Resolution on further developing the European Education Area to support future-oriented education and training systems. Retrieved September 26, 2020, from <https://data.consilium.europa.eu/doc/document/ST-13298-2019-INIT/en/pdf>
- De Silva, M., & Rossi, F. (2018). The effect of firms' relational capabilities on knowledge acquisition and co-creation with universities. *Technological Forecasting and Social Change*, 133, 72-84. <https://doi.org/10.1016/j.techfore.2018.03.004>
- Drydakis, N. (2015). Economics applicants in the UK labour market: University reputation and employment outcomes. *International Journal of Manpower*, 36(3), 296-333. <https://doi.org/10.1108/IJM-02-2014-0061>
- Duggan, M., Ellison, N. B., Lampe, C., Lenhart, A., & Madden, M. (2015). Demographics of key social networking platforms. Pew Research Centre, 9. Retrieved from [www.pewinternet.org/2015/01/09/demographics-of-key-social-networking-platforms2/](http://www.pewinternet.org/2015/01/09/demographics-of-key-social-networking-platforms2/)
- Duque, L. C. (2014). A framework for analysing higher education performance: students' satisfaction, perceived learning outcomes, and dropout intentions. *Total quality management & business excellence*, 25(1-2), 1-21. <https://doi.org/10.1080/14783363.2013.807677>
- Dyson, B., Vickers, K., Turtle, J., Cowan, S., & Tassone, A. (2015). Evaluating the use of Facebook to increase student engagement and understanding in lecture-based classes. *Higher Education*, 69(2), 303-313. <https://doi.org/10.1007/s10734-014-9776-3>
- Eldegwy, A., Elsharnouby, T. H., & Kortam, W. (2018). How sociable is your university brand? An empirical investigation of university social augmenters' brand equity. *International Journal of Educational Management*, 32(5), 912-930. <https://doi.org/10.1108/IJEM-12-2017-0346>
- Elsharnouby, T. (2015). Student co-creation behaviour in higher education: the role of satisfaction with the university experience. *Journal of Marketing for Higher Education*, 25(2), 238-262. <https://doi.org/10.1080/08841241.2015.1059919>
- Faham, E., Rezvanfar, A., Mohammadi, S. H. M., & Nohooji, M. R. (2017). Using system dynamics to develop education for sustainable development in higher education with the emphasis on the sustainability competencies of students. *Technological Forecasting and Social Change*, 123, 307-326. <https://doi.org/10.1016/j.techfore.2016.03.023>
- Foroudi, P., Yu, Q., Gupta, S., & Foroudi, M. M. (2019). Enhancing university brand image and reputation through customer value co-creation behaviour. *Technological Forecasting and Social Change*, 138, 218-227. <https://doi.org/10.1016/j.techfore.2018.09.006>
- Fransen, M. L., & Van Rompay, T. J. (2011). Living Brands: Consumer Reactions toward Online Experienced-based Marketing Communication. In *Advances in Advertising Research*, 2, 311-324. Gabler. [https://doi.org/10.1007/978-3-8349-6854-8\\_20](https://doi.org/10.1007/978-3-8349-6854-8_20)
- Galinienė, B., Miškinis, A., Marčinskis, A., & Drūteikienė, G. (2009). The impact of study quality on the image of a higher education institution. *Informacijos mokslai*, 48, 68-81. Retrieved from <https://etalpykla.lituanistikadb.lt/object/LT-LDB-0001:J.04~2009~1367167976637/J.04~2009~1367167976637.pdf>
- Garabinović, D. (2019). Online marketing promotion of local tourism organizations: The analysis of the situation in Moravica administrative district. *Менаџмент у хотелијерству и туризму*, 7(1), 71-81. <https://doi.org/10.5937/menhottur1901071G>
- Heding, T., Knudtzen, C. F., & Bjerre, M. (2009). *Brand Management: Research Theory and Practice*. USA: Routledge Press
- Hesel, R. A., & Williams, R. C. (2009). Social networking sites and college-bound students. *Student Poll*, 7(2), 1-8.
- Huang, C., & Lien, H. (2012). An empirical analysis of the influences of corporate social responsibility on organizational performance of Taiwan's construction industry: Using corporate image as a mediator. *Construction Management and Economics*, 30, 263-275. <https://doi.org/10.1080/01446193.2012.668620>
- Huynh, T., & Nguyen, N. (2015). Communicating university brand via social media: case: communicating Lahti University of Applied Sciences brand to international students using social media. Retrieved from <http://www.theseus.fi/handle/10024/98361>
- Ivanović, M., Miličević, A. K., Aleksić, V., Bratić, B., & Mandić, M. (2018). Experiences and perspectives of Technology enhanced learning and teaching in higher education—Serbian case. *Procedia Computer Science*, 126, 1351-1359. <https://doi.org/10.1016/j.procs.2018.08.086>
- Kaplan, A.M., & Mazurek, G. (2018). Social Media: State of the Art and Research Agenda. In B. Mierzejewska, J. Jung, & A. Albarran (Eds.), *Handbook of Media Management and Economics* (pp. 273-286). London: Routledge.
- Kelleher, T., & Sweetser, K. (2012). Social media adoption among university communicators. *Journal of Public Relations Research*, 24(2), 105-122. <https://doi.org/10.4018/IJOM.2015070104>
- Kelly, L., Kerr, G., & Drennan, J. (2010). Avoidance of advertising in social networking sites: The teenage perspective. *Journal of interactive advertising*, 10(2), 16-27. <https://doi.org/10.1080/15252019.2010.10722167>
- Kheiry, B., Rad, B. M., & Asgari, O. (2012). University intellectual image impact on satisfaction and loyalty of students (Tehran selected universities). *African journal of business management*, 6(37), 10205-10211. <https://doi.org/10.5897/AJBM11.434>
- Küçüksüleymanoğlu, R. (2015). Organizational image perceptions of higher education students. *Educational Research and Reviews*, 10(20), 2667-2673. <https://doi.org/10.5897/ERR2015.2443>
- Kumar, V., & Nanda, P. (2019). Social media in higher education: A framework for continuous engagement. *International Journal of Information and Communication Technology Education* 15(1), 97-108. <https://doi.org/10.4018/IJICTE.2019010107>
- Kumar, V., & Nanda, P. (2020). Social Media as a Tool in Higher Education: A Pedagogical Perspective. In *Handbook of Research on Diverse Teaching Strategies for the Technology-Rich Classroom* (pp. 239-253). IGI Global.
- Kuzma, J. M., & Wright, W. (2013). Using social networks as a catalyst for change in global higher education marketing and recruiting. *International Journal of Continuing Engineering Education and Life Long Learning*, 23(1), 53-66. <https://doi.org/10.1504/IJCEELL.2013.051766>

- Kuzmanovic, J., Labrovic, A.J., & Nikodijevic, A. (2019). Designing e-learning environment based on student preferences: conjoint analysis approach. *International Journal of Cognitive Research in Science, Engineering and Education*. 7(3), 37-47. <https://doi.org/10.5937/IJCRSEE1903037K>
- Lafuente Ruiz de Sabando, A., Forcada Sainz, F. J., & Zorrilla Calvo, M. P. (2018). The university image: a model of over-all image and stakeholder perspectives. *Cuadernos de Gestion*, 19(1), 63-86. <https://doi.org/10.5295/cdg.160720al>
- Lievens, F. (2017). Organizational image/reputation. In: S. Rogelberg & C.L. Reeve (Eds.) *The Encyclopedia of Industrial and Organizational Psychology* (pp. 1116-1118), 2<sup>nd</sup> edition. Thousand Oaks, CA: Sage.
- Lindbeck, R., & Fodrey, B. (2010). Using technology in undergraduate admission: A student perspective. *Journal of College Admission*, 208, 10-17. Retrieved from <http://www.nacacnet.org>
- Mackelo, O., & Drūteikiėnė, G. (2010). The Image of a higher education institution, its structure and hierarchical level: the case of the Vilnius university faculty. *Ekonomika*, 89, 105-121. <https://doi.org/10.15388/Ekon.2010.0.972>
- Manca, S., & Ranieri, M. (2016). "Yes, for sharing, no for teaching!": Social media in academic practices. *The Internet and Higher Education*, 29, 63-74. <https://doi.org/10.1016/j.iheduc.2015.12.004>
- Mazurek, G., Korzyński, P., & Górska, A. (2019). Social Media in the Marketing of Higher Education Institutions in Poland: Preliminary Empirical Studies. *Entrepreneurial Business and Economics Review*, 7(1), 117-133. <https://doi.org/10.15678/EBER.2019.070107>
- McDougall, J., Readman, M., Wilkinson, P. (2018). The uses of (digital) literacy. *Learning, Media and Technology*, 43(3): 263-279. <https://doi.org/10.1080/17439884.2018.1462206>
- Merrill, N. (2011). Social media for social research: Applications for higher education communications. In *Higher education administration with social media*. Emerald Group Publishing Limited.
- Milićević, S., Petrović, J., & Đorđević, N. (2020). ICT as a factor of destination competitiveness: The case of the republics of former Yugoslavia. *Management & Marketing*. 15(3), 381-392. <https://doi.org/10.2478/mmcks-2020-0022>
- Minocha, S. (2009). Role of social software tools in education: A literature review. *Education + Training*, 51, 353-369. <https://doi.org/10.1108/00400910910987174>
- Nguyen, N., & LeBlanc, G. (2001). Image and reputation of higher education institutions in students' retention decisions. *International journal of educational management*. <https://doi.org/10.1108/EUM0000000005909>
- Nyangau, J. Z., & Bado, N. (2012). Social Media and Marketing of Higher Education: A Review of Literature. *Journal of the Research Center for Educational Technology*, 8(1), 38-51. Retrieved from <http://rcetj.org/index.php/rcetj/article/view/180/264>
- Pampaloni, A. (2010). The influence of organizational image on college selection: what students seek in institutions of higher education. *Journal of Marketing for Higher Education* 20(1):19-48. <https://doi.org/10.1080/08841241003788037>
- Pérez, J. P., & Torres, E. M. (2017). Evaluation of the organizational image of a university in a higher education institution. *Contaduría y administración*, 62(1), 123-140. <https://doi.org/10.1016/j.cya.2016.01.007>
- Peruta, A., & Shields, A. B. (2018). Marketing your university on social media: A content analysis of Facebook post types and formats. *Journal of Marketing for Higher Education*, 28(2), 175-191. <https://doi.org/10.1080/08841241.2018.1442896>
- Polat, S. (2011). The relationship between university students' academic achievement and perceived organizational image. *Educational Sciences: Theory & Practice*, 11, 257-262. Retrieved from <https://eric.ed.gov/?id=EJ919900>
- Powers, T., Advincula, D., Austin, M. S., Graiko, S., & Snyder, J. (2012). Digital and social media in the purchase decision process: A special report from the Advertising Research Foundation. *Journal of advertising research*, 52(4), 479-489. <https://doi.org/10.2501/JAR-52-4-479-489>
- Pucciarelli, F., & Kaplan, A. (2016). Competition and strategy in higher education: Managing complexity and uncertainty. *Business Horizons*, 59(3), 311-320. <https://doi.org/10.1016/j.bushor.2016.01.003>
- Radovanović, D., Hogan, B., & Lalić, D. (2015). Overcoming digital divides in higher education: Digital literacy beyond Facebook. *New media & society*, 17(10), 1733-1749. <https://doi.org/10.1177/1461444815588323>
- Roblyer, M. D., McDaniel, M., Webb, M., Herman, J., & Witty, J. V. (2010). Findings on Facebook in higher education: A comparison of college faculty and student uses and perceptions of social networking sites. *The Internet and higher education*, 13(3), 134-140. <https://doi.org/10.1016/j.iheduc.2010.03.002>
- Simões, C., & Soares, A. M. (2010). Applying to higher education: information sources and choice factors. *Studies in Higher Education*, 35(4), 371-389. <https://doi.org/10.1080/03075070903096490>
- Slover-Linett, C., & Stoner, M. (2011). Succeeding with social media: Lessons from the first survey of social media in advancement. *Slover Linett Issue Paper Series*, 1-37. Retrieved from [https://nexttrends.swissnexsanfrancisco.org/wp-content/uploads/sites/5/2011/03/case\\_succeeding-with-social-media.pdf](https://nexttrends.swissnexsanfrancisco.org/wp-content/uploads/sites/5/2011/03/case_succeeding-with-social-media.pdf)
- Smith, K. T. (2011). Digital marketing strategies that Millennials find appealing, motivating, or just annoying. *Journal of Strategic Marketing*, 19(6), 489-499. <https://doi.org/10.1080/0965254X.2011.581383>
- Štefko, R., Fedorko, R., & Bačik, R. (2015). The role of e-marketing tools in constructing the image of a higher education institution. *Procedia-Social and Behavioural Sciences*, 175, 431-438. <https://doi.org/10.1016/j.sbspro.2015.01.1220>
- Stević, N., Vujičić, D., & Lalić, D. (2017). Visibility of Serbian State Universities on The Internet and Social Media. *International Scientific Conference on Industrial System (IS'17)*. Retrieved June 29, 2020, from <https://www.iim.ftn.uns.ac.rs/is17/papers/90.pdf>
- Sung, M., & Yang, S. (2008). Toward the model of university image: The influence of brand personality, external prestige, and reputation. *Journal of Public Relations Research* 20(4): 357-376. <https://doi.org/10.1080/10627260802153207>
- Tess, P. A. (2013). The role of social media in higher education classes (real and virtual) - A literature review. [online]. *Computers in Human Behavior*, 29(5), A60-A68. <https://doi.org/10.1016/j.chb.2012.12.032>
- Tezer, M., Taşpolat, A., Sami Kaya, Ömer, & Fatih Sapanca, H. (2017). The impact of using social media on academic achievement and attitudes of prospective teachers. *International Journal of Cognitive Research in Science, Engineering and Education (IJCRSEE)*, 5(2), 75-82. <https://doi.org/10.5937/IJCRSEE1702075T>
- Van Riel, C. B., & Fombrun, C. J. (2007). *Essentials of corporate communication: Implementing practices for effective reputation management*. Routledge.
- Vogler, D. (2020). The effects of media reputation on third-party funding of Swiss universities. *Journal of Communication Management*. <https://doi.org/10.1108/JCOM-04-2019-0059>

Vukić et al. (2021). Students' perception and attitudes toward faculty image on social networks, *International Journal of Cognitive Research in Science, Engineering and Education (IJCRSEE)*, 9(1), 63-74.

---

Vukić, M., & Vukić, M. (2019). The impact of social media on the recruitment of students by higher education institution. *Tourism International Scientific Conference Vrnjačka Banja - TISC*, 4(1), 307-326. Retrieved from <http://www.tisc.rs/proceedings/index.php/hitmc/article/view/258>

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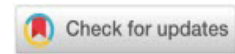
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# International Student Exchange Management as Factor of Educational Services Development

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**Abstract:** Since the beginning of XXI century higher education internationalization trend has been intensifying around the world. The goal of the research is to study managing international education characteristics to promote educational services export. Levels of interconnection and interdependence between economic agents around the world are increasing; transnational forms of economic activity, information and communication technologies are developing. The market for higher education is developing intensively as educational services of the highest international level demand is increasing. The research goal is to analyze the main economic tendencies in modern students' exchange programmes. The problems discussed are the need to increase educational services export by promoting it using various student exchange models, study of managing international education characteristics to promote educational services export and its development. For this purpose the methodology consisting of modeling educational policy processes and analyzing the results is used. The results of the study show that higher education takes on international socio-economic features, which are to be seen as an attractive investment target. Modern higher education is developing in the conditions of open access and mutual influence of conditions in different countries, depending on the basis of economic, political and cultural relations. The growing interest in education abroad leads to existing paradigm of educational services management review thus updating this study's topic. In the conclusion we highlight that integrative processes in internationalization of education management can significantly enrich practical application in this sphere. Recommendations in this study can be used to increase educational services export and import.

*Keywords:* student exchange, education management, education export, international education, academic mobility.

## Introduction

Many scholars note that "information, knowledge and innovations, as well as ways of their practical application, are increasingly considered as a source of profit in a post-industrial society" (Ussenova et al., 2020). In this situation, education has taken a leading place in the world economic development, increasing labour productivity, human capital quality, and the long-term results of the social production efficiency growth. According to British scholars Bridges and Bridges (2017); Menzies and Baron (2014), "transnational education refers to all types of higher education programs, complexes of educational courses or educational services, dual enrolment opportunities, summer bridge programs and team projects". Such programmes can be provided by a country's educational system or may be independent of any systems at all. International students' exchange may be studied theoretically and applied practically. According to different researches' meta-analysis, the main problems of students' exchange are the institutionalization of international education and management of students' needs, psychological and social support shapes and structure, and the transition from the national to international. Thus, "research focuses on the methods of internationalization at the individual, institutional, and national levels" (Bedenlier et al. 2018, p.108).

So far, international education has significantly changed its direction. The term "education export" has appeared. The programs of double and multiple diplomas, the International affiliations of the world's leading educational institutions, franchised universities and joint programmes of international education

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have been developed. There is an urgent need in standard procedures, educational quality criteria, regulatory policies and tendencies monitoring development. "The international protocol for worldwide collection of transnational education data is developing, similar to what United Nations Educational Scientific and Cultural Organization (UNESCO) and Organization for Economic Co-Operation and Development (OECD) do for international student mobility" (Knight, 2016, p.34).

Researchers argue that political factors are overestimated, but the need for systematic long-term planning is underestimated. Anyway, the internationalization of education and academic mobility programs are neither uniform nor linear. They are aimed at long-term processes, the results of which are uncertain, since they are difficult to predict in the context of rapid social, political and economical change (Dakowska, 2017, p.588). Specific tasks include joint educational programs and double-degree programs facilitating the new programs development, knowledge and experience sharing; individual teachers' mobility programs, visiting professors' lectures delivering etc. International students' and teachers' mobility consists of "training, data collection for research, internships, job shadowing, a staff training week attending, joint projects implementation" (Makarova, Makarova and Hjaltadottir, 2019). Thus, experience shows that international exchange programs and students' support are effective when they are established on the foundation of the development of the national education system priority areas. For example, the International Baccalaureate program existing in a number of world universities is focused on intra-personal, inter-personal qualities and pro-social development. It pays attention to the holistic development of personal traits, including pro-social behaviour shaping (Bailey and Cooker, 2018 p.228).

Staff mobility plays a significant role in international education development. The involvement of foreign professors and researchers into university activities is "one of the competition areas in the international market of educational goods and services" (Ismailova et al., 2020). The world's leading universities usually have an international team of scientists and professors; foreign teaching staff percentage in the educational process is one of the most impressive indicators in the world's leading universities rankings. The world leader in international education development is the United States of America. According to statistics, foreign professors make up 33% of the total faculty at the US universities, while in Russian universities the share of foreign instructors ranges from 0 to 5%, most of them in leading institutes or federal universities in Moscow. Foreign professors Invitation targets achieving several academic and non-academic goals, the major one being the university's competitive qualities development and the ranking in the world system. Mentioning other goals, we call the range of educational programs expansion, which means integrated and joint training programs inclusion, English language education programs implementation, compliance with international educational standards and demands, new research areas development demanded by the global scientific community, development of the university's positive image, and improvement of its recognition in the world.

An important tendency in the world education development is the introduction of digital and network technologies into education and transition to online learning, having two sides. First of all, digital technologies, gamification, edutainment are substituting traditional classroom learning. "New information technologies are becoming an important aspect of the international educational context as much as the content of education and the people who participate in it" (Mcvicar, 2015).

Another educational trend is educational organizations integration. This includes various participants in educational goods and services market, involving potential employers, national and international services providers, even those companies that have never dealt with educational goods and services before. Another effective tool in the world market of educational goods and services competition has been the growth of mergers of academic institutions or integration of individual institutions as faculties of universities or academies. The universities in Finland, for example, are heading most consistently in this direction; as a result of the merger, new educational institutions are being formed to become leaders in national education. Similar processes take place in Denmark: 8 universities and 3 research centres were established out of 25 universities and research centres. The expansion of universities in Europe and the USA during the last 20–30 years is a global tendency. Among the objectives of this tendency, experts usually highlight the universities intention to improve not only their performance in the national market of educational goods and services, but also their international rankings.

As noted by Knight J. (2018), "there are three different principles underlying the formation of educational hubs as a new form of international educational centres - the student hub, the talent hub, and the knowledge and innovation hub". Such integrated units can be built upon three different foundations. They can be focused on students engaged in the recruitment of foreign citizens eager to get education in RF. In addition to student recruitment, such centres are developing new promising joint or franchising programs, double and multiple diplomas programs, targeting not only foreign, but also local students.

Another type of educational integrators is the centre of talent; their main task is human resources

development. The main goals of such integrators are expressed in attracting talented youth and skilled workers from abroad. Educational integrators of the third type are Knowledge and Innovation Hubs; their main activity is scientific research for the production and dissemination of new knowledge and introduction of innovations. The goals of such integrators are the creation of favourable conditions for research activities, foreign investments attraction, competitiveness of applied scientific research development and increase (Buckner, 2017 p. 296).

According to Organization of Economic Cooperation and Development, “the number of students getting education outside their own country) increased threefold from 1990 (1.3 million people) to 2011 (4.3 million people)”. According to the UNESCO forecast, “the number of students learning outside their native country will reach 7.2 million by 2025” (Amirov, 2018). This perspective is associated with the state education regulation intensification in many countries. “Annually different international higher education scholarship programs attract a significant amount of funds from national governments, supranational organizations, large charities, higher education institutions and many other smaller organizations. Internationally targeted scholarships fund students in higher education institutions around the world” (Mawer, 2017). The US government identifies promising in the area of education target countries, recruits educational institutions that are interested in expanding their international involvement and foreign students’ enrolment, and promotes these programs to students, teachers, and educators in the target market also providing assistance in receiving certain types of scholarship and grants. Education ranks fourth in terms of exports, second only to exports of dairy products, tourism and meat. In addition, international education makes a significant contribution to the labour market and supports world’s economy.

In Russia Global Education state program was recognized and successfully implemented in many state educational institutions in 2013. Russian education export system has a great developmental potential, as many foreign experts have noted; budgetary revenue from educational services export will grow from 78 billion rubles in 2017 to 198 billion rubles in 2025. Financing is through contributions of the RF budget and private donations from sponsors’ to a special educational fund. The program participant’s fees for tuition; accommodation; transportation costs and educational resources are paid through the fund in advance, while medical insurance and personal expenses are reimbursed. The largest number of universities approved by this Program is in the countries whose universities are leaders in higher education (the US, Great Britain, Germany, and Canada). Improvement of Russian education competitiveness in the international market of educational goods and services is associated with the internationalization strategies for education system levels development and improvement.

## Materials and Methods

### International Education Management: Models and Educational Policy Processes

Management of higher education, including international, has its own peculiarities, associated with the special status of higher education institutions. On the one hand, universities are educational, scientific and cultural centers that meet the requirements of society and the state in preparing professionals needed by the economy and in increasing new knowledge and innovations. This is the social significance of universities. On the other hand, universities are included in the market of educational goods and services as entities producing and selling services. This is the economic importance of universities as full-fledged subjects of market economy (Pashakhina, 2020 p.110).

According to Etzkowitz H. (2016), universities acquire entrepreneurial traits, transforming knowledge into economic activity, playing a creative role in the economic and social development of education both at the state level of one country and in the international education market. There is a clear idea that despite the participation and various external factors influence, the three main actors in the educational policy are the state, an educational organization and business (Cai and Etzkowitz, 2020).

Speaking about the adaptability of each model to a rapidly developing market, we should note that the one with the greatest variety of educational activity agents, sources of financing, a high level of educational organizations autonomy and academic mobility will be most adaptable. With regard to the management of international education in Russia, it is necessary to distinguish three levels of the agents: federal, regional and university (Bondarenko et al., 2018, p.6).

At the level of federal government and departments, state policy target guidelines in the field of international education and educational services export are set; priority federal projects in the education field and the main directions implementation are developed. The objectives of the state educational policy are to expand the export of educational goods and services as a form of non-resource export, the inflow of labour capital, attracting talented foreign students, Russian education brand promotion abroad, and

Russian language and culture popularization among foreign citizens.

The following frameworks are being developed at the federal level: framework governing foreign students' entry into the country; a system of quotas for foreign students; bilateral agreements between states.

International education management at this level has a number of features:

- territorial support programs for academic mobility are developed and implemented,
- information centers are created to support, adapt and interact foreign students with the local community,
- procedures are developed to solve the problem of foreign citizens studying in the region employment.

These activities entrepreneurial nature allows for a new way of presenting and flesh out the main functions of the educational organization of higher education in international activity. The university's traditional business functions are teaching and training; researching, marketing, financial and economic activities.

According to researchers (Gaus and Raith, 2016), education, research and entrepreneurial functions are included in the university's business process system. The international activity of educational organizations allows for the use of the above mentioned business processes. Management of these university business processes is carried out in the following areas: financing sources that provide funding; distribution channels through which it is transmitted; customer segments as the main target purchasers of goods; sources of revenue generation; costs implementation directions (Silakova, 2017).

Entrepreneurial business process is expressed in the diversification of educational services, educational programs of various durations, target audience, level of education, and technologies applied in teaching and training. An important part of the entrepreneurial process is the expansion of consulting services range for the state, business and citizens and these services launch into international market.

Summing up the results of theoretical analysis, a number of basic principles are formulated. Modern international education develops very intensively. The main trends are related to integrative processes in higher education, increasing academic mobility level, strengthening state regulation role, digital and network technologies, as well as individualization of educational trajectories for talented students.

Analysis of the Global Market for International Education. The global market of educational goods and services is developing rapidly involving all countries of the world. Researchers say that international education market development has both economic and social significance. Education as a type of service is a special line of business, and today the leading players in this market receive substantial income from training foreign students. In educational economy, knowledge is the main factor in goods and services production. Economy based on knowledge has succeeded in creating prosperity and wealth with participation of gifted and talented people, high intelligence, professional skills, and a wide range of diverse demands from society and the Government.

According to OECD estimates, around 140 million students in the world are studying in 36 thousand higher education institutions. Most of them get education in their own country. However, the number of students studying abroad is growing rapidly. According to UNESCO, the number of international students in the world is growing steadily; in 2017 it amounted to more than 5.341 million people. As shown in Figure 1, in 2000 this indicator was at the level of 2.1 million, in 2003 it was 2.65 million, in 2007 it overcame the mark of 3 million, in 2013 it exceeded 4 million, and in 2016 it reached 5 million people.

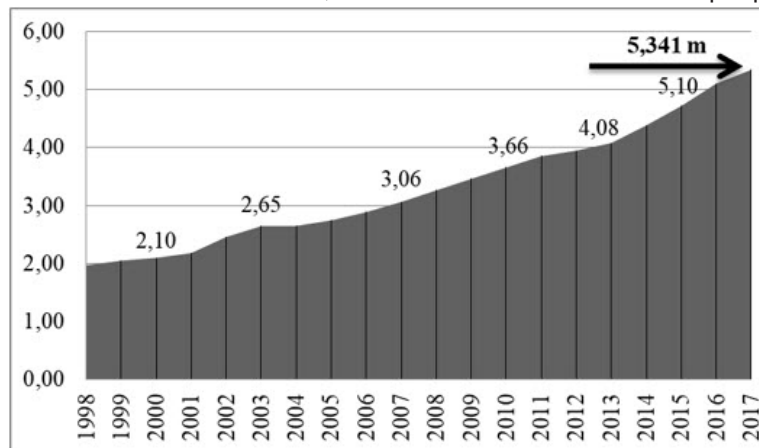


Figure 1. The number of international students in 1998-2017, million people

The main segment of the international educational services market is higher education programs. The share of countries participating in the educational market of goods and services is heterogeneous. Today, this market prevailed mainly in three countries in different parts of the world: the USA, Great Britain and Australia, all of them are English-speaking.

Figure 2 shows the latest OECD (2019) data on the market for international educational services, the share of foreign students studying in each country of destination, in terms of all mobile students in the OECD and partner countries. As shown at Figure 2, the leading positions are occupied by the United States, teaching 22% of all international students of the world, the UK is second with a share of 10%, Australia is third (9%), having recently significantly strengthened its position in the educational market. Fourth, fifth and sixth places are divided among three countries of Europe - the Russian Federation, France and Germany (6% each). Fourth, fifth and sixth places are divided among three countries of Europe - the Russian Federation, France and Germany (6% each).

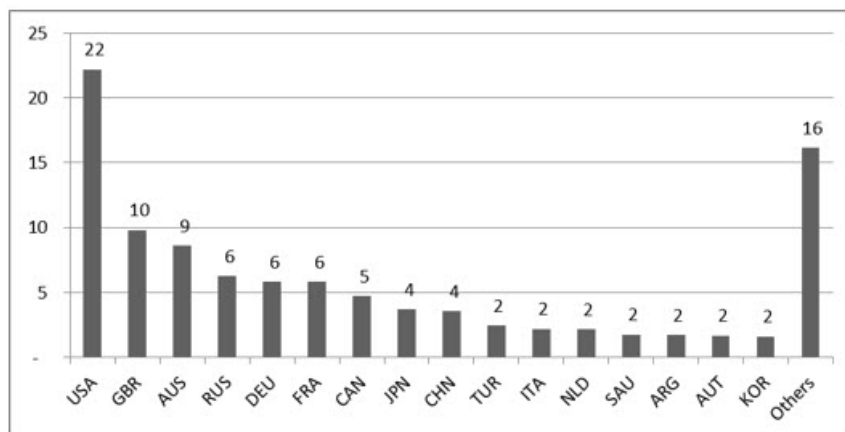


Figure 2. International students enrolled in each destination country as a share of all mobile students in OECD and partner countries (2017), %

Thus, students mostly study in Europe, where they are distributed across several countries (France, Germany, the Russian Federation, Austria, Italy, the Netherlands, Turkey and others). Although North America takes fewer students in absolute terms, the United States holds firm leadership positions not only on the continent, but also in the world. A large number of foreign students in English-speaking countries indicate a high level of interest in English-language education. Table 1 shows the dynamics and changes in the percentage of foreign students studying in a particular country.

**Table 1**

*Percentage of foreign students in the given country (2010, 2013, 2017)*

Country	Percentage of foreign students		
	2010	2013	2017
Australia	22,08	17,97	21,48
United Kingdom	16,04	17,46	17,92
Canada	no data	9,72	12,92
France	no data	9,78	10,20
Germany	7,99	7,07	8,37
United States	3,54	3,87	5,18
Japan	no data	3,43	4,27
Russian Federation	2,02	1,84	4,08

Source: OECD/UIS/Eurostat (2019).

As can be seen from the data, Australia holds the leading position in this issue, where the share of foreigners is the highest - from 17% to 22%. A large percentage of foreign students is traditionally seen in the UK (16-17%, and the percentage is growing). Positive dynamics is in Canada (9-12%), the USA (3-5%) and the Russian Federation (1-4%). However, among the leading countries in the international market of educational goods and services demonstrated in Table 1, Russia occupies the lowest position; it is in the eighth line. Comparing other data, we can say that postgraduate education of foreign students is one of the most important areas in the global educational services market. High percentages for master's and

doctoral programs are noted in all countries - leaders of the international education market. According to doctoral programs, the first place belongs to the UK (42.1%), according to master's programs - to Australia (47.7%). An interesting trend is found in Australia - a rather high percentage of short-term students (20.2%). In Canada, this share is 12.7%, and for the rest of the market participants this segment of educational services is poorly represented or not represented at all, as in Germany, for example. Meanwhile, short-term educational programs are becoming increasingly relevant in the context of individual educational trajectories and the concept of life-long education. Development of short-term programs (for example, for improving language competencies in a native language environment) can become a significant advantage for the country in the international educational services market.

All countries of the world that are the major players in the educational market and in the export of educational goods and services can be divided into two main groups - hard and soft sellers. The hard sellers in the market of educational goods and services are Denmark and the UK in Europe, Argentina and Brazil in South America, Canada and the USA in North America, India, Australia, and New Zealand in other parts of the world. In these countries the universities occupy the highest positions in the world rating that is why the tuition fee is usually threefold compared to other universities of the same rank in other countries. For soft sellers, the tuition fee for foreign students is compensated by payments from the budget sources. For example, in Germany, France, Finland, Sweden, foreign students do not pay for their study in state universities, but have to pay if they enter some private educational institution. Thus for such a country that provides educational goods and services, the profit from educating foreign students is not in a tuition fee, but in money paid for accommodation, food, travelling, entertainment, books, stationary etc. In addition, such countries get profit when they attract educated emigrants to their labour markets who will stay in the country after graduation and start working in different areas of economics.

Tuition fee is also a sophisticated financial mechanism that can regulate the domestic market of educational goods and services. For example, in Great Britain EU countries students' expenses are completely different from those of other countries' students (depending on the status of the university), but these expenses are lower for British citizens anyway. In this way, the university gets enough money for its existence and prosperity without raising prices for national students training.

With such a sophisticated market strategy, the university can meet the requirements of the national industry development and innovative technologies introduced; the need in skilled staff; demographic changes; standardized legal space, national government attitude to education in general, education development and advance in compliance with the progress, etc. Without taking all these factors into account, expanding the borders of the market and increasing profits are not possible; exports in general are not conceivable.

There are many TNCs: DAAD (Germany), British Council (Great Britain), CIMO (Finland), IDP Education Australia (Australia), EduFrance (France) and others. Some of them are engaged exclusively in education, and some are in related areas - culture and art. The daily practice of TNCs includes hundreds of projects: they support development and distribution of national language programs, arrange student and staff mobility, provide support in information dissemination and advisory services, etc. The TNC format has proved to be extremely productive both for students and staff.

A significant part in students' mobility setup is played by international unions and organizations with academic focus. NAFSA (Association of International Educators) is the world's largest non-profit association dedicated to international education and academic exchange. NAFSA's 10,000 members are located at more than 3,500 institutions worldwide, in over 150 countries. European Association for International Education (EAIE) is the European centre where experts work creating networks and resources and providing higher education globalization. EAIE is a non-profit, non-governmental organization helping people worldwide to get education in a foreign country through a combination of academic training, scientific conferences and forums, knowledge dissemination and sharing. EAIE assists academic and non-academic professionals in their challenge to get through; by providing opportunities of international exchange. EAIE partners promote membership interests and advance international higher education in Europe and in the rest of the world. These organizations show that the international market for educational goods and services can be structured from different points of view, not from the point of financial profit, but of academic and scientific benefit for the whole mankind. This market includes enrolment of students, establishment of campuses and branches abroad, as well as distance learning.

Features of Educational Services Export Management in Russia. The first lines in the ranking of the best world universities are consistently occupied by the universities in the USA and the UK. Traditionally, the group of countries with a developed education system also includes Switzerland, Australia, Canada and China. According to QS World University Rankings 2020, Moscow State University remains the best Russian university in the QS ranking - 84<sup>th</sup> place, rising six positions compared to last year. The second

place among Russian universities was occupied by Novosibirsk State University (231<sup>st</sup> position), the third - St. Petersburg State University (234<sup>th</sup> position). In total, 25 Russian universities entered the top 1000, with 15 of them improving their positions constantly. Massachusetts Institute of Technology (MIT) has been recognized as the best in the world for the eighth consecutive time.

In 2017 the RF Government adopted an academic document “Export potential of the Russian educational system development” containing predictions of results and methods for achieving goals in the field of expanding the education export potential of the RF by 2025. The key goal of this academic project is to significantly increase Russian education’s competitiveness in the international market of educational goods and services and thereby to enhance non-resource exports of Russia. For this programme implementation it is necessary to design and develop the university’s versatile strategy in the education export, it is also necessary to mold certain services to support foreign students. By implementing this project the RF Government is planning to attract full-time students from foreign countries up to the number of 510 thousand people, and the extra-budgetary funds received from the Russian education export will go up to 303,147 million Russian rubles.

The Russian statistical collections (Federal State Statistic Service) prove that every year the number of foreign students in higher education programs is increasing. Comparing predictions with the real numbers, we can see that over the period of 5 years, the total number of foreign students has grown by 64,442 people, full-time students by 41,296 people. The number of foreign students enrolled in RF universities is steadily growing, and the number of foreign universities participating in the priority project is growing (Figure 3). At the moment there are 39 of them, but according to the project, by 2021, all the Russian universities should use the “Model for education export.”

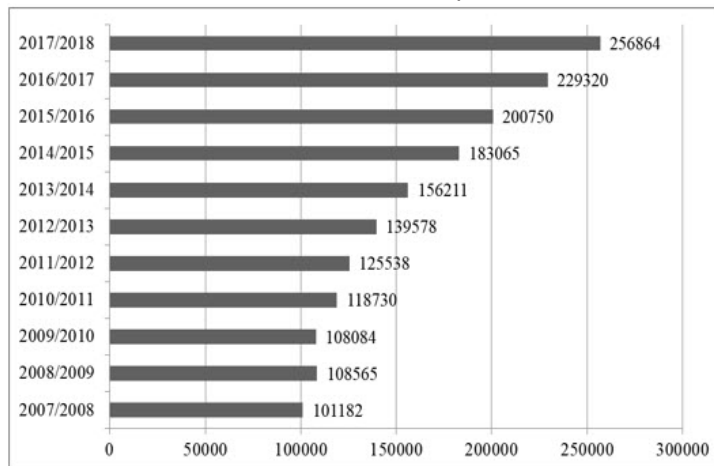


Figure 3. Foreign students enrolled in Russian universities (2007-2018), people  
Source: Russia in numbers. 2007-2019. Rosstat

The percentage of foreign students enrolled in RF universities at all the levels is growing steadily. Fig. 4 shows the ratio of foreign students to the total number of students (percentage). As can be seen from the data presented, in 2017 this share was 7.1% and over the past few years has grown several times.

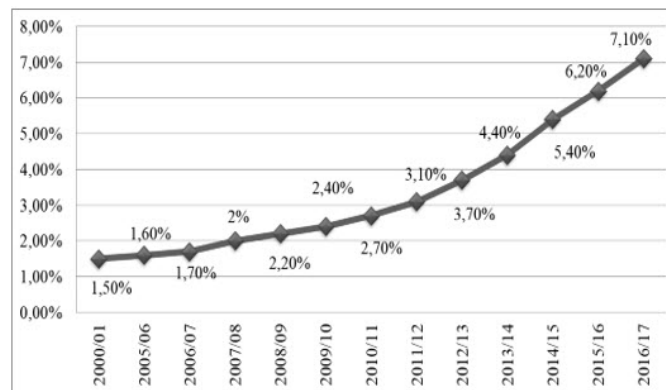


Figure 4. The ratio of foreign students to the total number of students in RF universities (2000 – 2017), %

Source: Russia in numbers. 2000-2018. Rosstat

According to statistics, about 80% of all foreign students study at the undergraduate level; this percentage has grown steadily over the course of several years (from 63.48% in the 2006–2007 academic year to 80% in the 2017–2018 academic year). The share of students in the Master’s program ranges from 14.15% in 2014–2015 to 23.36% in 2009–2010, while there is a tendency for reduction. In 2017–2018 academic year, the share of students in the Master’s program is about 15%. As for post-graduate education, an even more significant decrease is observed in this sector of education - from almost 15% in 2006–2009 to 4.85% in the 2017–2018 academic years. It can be concluded that foreign students are more interested in obtaining a bachelor’s degree in higher education institutions of the Russian Federation than in Master’s or Doctorate programs.

The success of educational services export depends to a great extent on the number of students getting education on a commercial basis and on the cost of training. Fig. 5 presents the dynamics in the increase of foreign students enrolled in higher education institutions on a commercial basis in 2014–2018. As shown, this indicator decreases annually, with the largest drop in 2015. Further, the decline slowed down, but the number of the countries exporting students continues to decline.

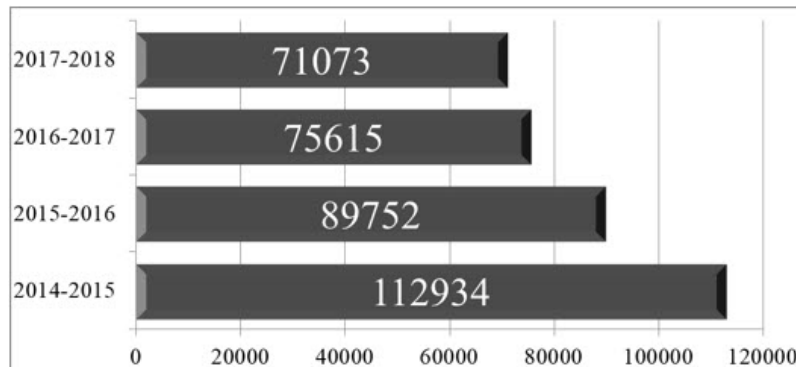


Figure 5. The number of foreign citizens studying in higher education organizations on a contract basis for 2014–2018, people

Source: Russia in numbers. 2014–2019. Rosstat

In 2018, according to the statistical digests, the number of foreign students was grouped into those who studied in state or community universities, and those who studied in private educational institutions. In 2015–2016 there was a slight decrease in the number of foreign students enrolled in private educational institutions. Income from the export of educational goods and services is presented in Figure 6. The revenues of state and municipal universities from the export of educational goods and services are expectedly higher than those of private ones, but there is a noticeable upward tendency in both groups.

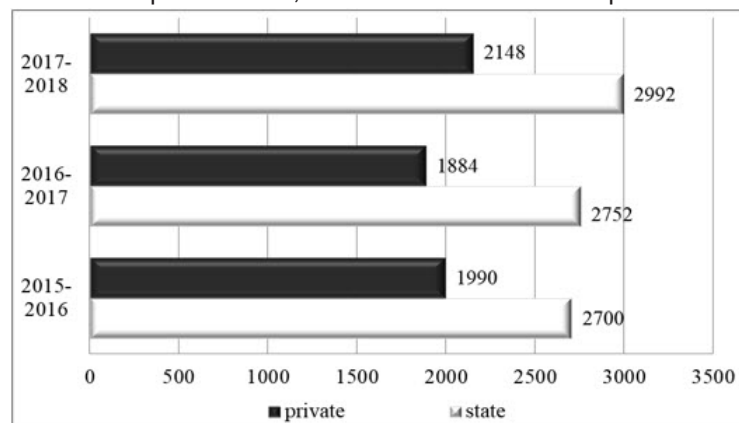


Figure 6. Total tuition fees for foreign and international students in public and private educational institutions of the Russian Federation, million rubles

Source: Russia in numbers. 2015–2019. Rosstat

All the foreign students enrolled in RF universities are unevenly distributed across the regions of the country. Russia is not a very successful player in the export market of educational goods and services, but strengthening its position from day to day. This is facilitated by the implementation of state priority projects and models for managing international education.

Models for Managing International Education and Promoting Educational Services Abroad. Currently, each country as a serious player in the market of educational goods and services is making special efforts to internationalize educational services. This is done both at the state level and with public-private partnership, as well as mutually beneficial triangular relations between the state, business and education. [Hawawini G. \(2016\)](#) describes five models of internationalization of education: Export Model, Import Model, Academic Joint Venture Model, Partnership, Alliance & Consortia Model, Foreign Campus Model.

Export Model is implemented for educational services distribution abroad, attracting foreign and international students to study in full-time programs. Upon educational program successful completion, foreign students receive a degree, diploma or certificate. Such students pay for their studies either on their own, or with grants and scholarship support by non-governmental and non-profit organizations and endowment funds ([Makarova, Makarova and Korsakova, 2019](#)). There is an indirect option for foreign students, when they study without paying tuition fee, but at the expense of the host state. However, they pay for accommodation, meals and other household and cultural needs. The economic effect is the sum of all foreign students' expenses during their stay on the territory of a host state.

Import Model suggests foreign instructors' involvement. Knowledge and experience that foreign experts possess is imported, and an educational institution profit depends on the number of students enrolled in a visiting professor's course. Often the result of such a model implementation is certificates of additional education received. International education may exist as an inclusive education program. By participating in this program, a student studies at a leading university and receives a diploma, while participating in a course offered by a partner university, with the subsequent issuing of a certificate of additional education. Examples of such a model can be found in almost every Russian university, where foreign teachers work. Leading universities implement various programs for foreign teachers' recruitment (Fellow, Post-Doctoral Fellow, or Visiting Professor programmes).

Academic Joint Venture Model is implemented in joint educational programs with double and multiple diplomas granted. At the same time, students have the opportunity to study full-time at least one or two semesters in a foreign university that is a partner of their national university. Graduates receive not only a "double set" of knowledge and competencies, but also a double diploma. This model is called the model of joint educational programmes, while it comes to the joint participation of two or more educational organizations in the design and implementation of the curriculum.

An alternative to this model can be a double diploma programme. Such programmes are characterized by the standards of terms and documents about education - a student studies at a foreign university for a long time and gets two diplomas of higher education. At the same time, the areas of training and majors can both coincide or vary. A student is enrolled in both universities simultaneously or sequentially and can study according to a jointly developed integrated curriculum. The economic effect of joint educational programs is associated with various options for tuition fee, but the greatest efficiency is in all educational organizations participating in joint educational programs promotion.

Partnership, Alliance & Consortia Model is considered as the basis for any interaction programs between educational and scientific organizations. Bilateral and multilateral agreements are signed, scientific and educational clusters are formed, including joint research projects, business incubators, and support for talented young scientists and entrepreneurs. In theoretical review, such a model is called a network university. This title contains an emphasis on educational activities, although network universities are also involved in science and entrepreneurship. Within the framework of network universities, educational programs are implemented, with pre-university training, summer schools, language courses, cultural exchange programs of particular importance.

Foreign Campus Model is a network of central university foreign branches with a developed network structure and general educational programs. Students get the opportunity to study at a university abroad remaining in their own country but participating in the work of this university branch or affiliation. According to the definition given by The Observatory on Borderless Higher Education experts, "a foreign branch of the university is its unit that meets the following criteria: managed directly by this university or jointly with a foreign organization, but on equal terms and acts on behalf of this university; graduates of the branch who study only in their country receive exactly the same diploma as graduates of the head university" ([Bischof, 2014, p.16](#)).

The sixth model which can be added to this description in modern conditions has received extremely widespread development – is Cross-border Online Education Model. Depending on the goals of the educational process, each educational institution can diversify its own online teaching and learning in its programmes. Undoubtedly opportunities given by online teaching, gamification, virtualization and digitalization in education allow overcoming time and space, decrease academic restrictions, provide

greater accessibility to special needs students compared to off-line classes. New technologies widen horizons and provide for internationalization of education all over the world.

Globalization helps with the transition to a digital academic environment, with corresponding digital competencies development of all the participants in the educational process. Digitalization along-side with globalization can completely change educational environment, the way of learning; competencies to be developed, educational institutions and criteria for evaluating students' success and progress. "Promising areas of digitalization are the use of simulators, project and collaborative learning technologies, adaptive and intuitive educational environment, mobile training applications, remote and virtual laboratories, and publicly available research data accumulation" (Barabanova et al., 2019, p. 94). Transition to digital education advantage is the development of general cultural competencies. All the gamers on this field improve their skills in solving problems, making decisions, processing information, communication, teamwork, understanding, self-knowledge and self-development (Makarova and Makarova, 2018, p. 57). The e-learning in European Higher Education Institutions report (Gaebel et al., 2014) notes that students with disabilities are interested in international online education, foreign students who choose online education as a more affordable alternative to full-time study abroad, working students and trainees advanced training, unemployed retraining, graduate students and adults who consider learning as leisure training.

There are several reasons that determine online education growing popularity. A significant impetus to its explosive growth was created by the situation of the forced self-isolation and the development of distance learning technologies during the COVID-19 corona virus pandemic. However, even before the pandemic, the online market of educational goods and services annual growth was registered at the level of 1.5-2%. This can be explained by the fact that online education makes it possible to get enrolled in a foreign university course, to listen to lectures and to go to classes, to receive foreign certificates, degrees and diplomas without leaving the comfort of your house.

According to Internet World Stats, the Russian-speaking audience of Internet users is growing rapidly. In 2020 its number was more than 116 million people, which is 2.5% of all Internet users, and has significant growth indicators. The leaders in this regard are English and Chinese languages. Based on this, one can talk about so the need to develop online courses in English and Chinese.

The priority state project "Modern Digital Educational Environment in the RF" sets goals to bring the number of online students up to 11 million people, and to develop at least 4,000 online educational courses and programs. For this project implementation, it is planned to attract 3,200 million Russian rubles from budgetary and extra-budgetary funds, the allocation of grants to form a system of requirements for the legal, organizational and technical support of online educational programmes, to assess their quality, and to improve teachers' qualification in online teaching.

Each of international and export of educational services models described above poses the issue of promoting educational services abroad and attracting foreign students. To attract foreign students and to diversify the number of participating countries, universities use various forms of recruiting: educational exhibitions and fairs; competitions, creative contests, career counselling events; online recruiting tools, posting information on social networks, the mass media; expanding opportunities and conditions for foreign students employment; national state and commercial educational portals together with international educational agencies and global students exchange programmes; designs of official university sites both in national and English languages; brochures and leaflets for foreign students distributed in embassies, representative offices and other state and public structures abroad; participation in international ratings, national scholarship programmes, spreading information through associations of foreign graduates; active marketing of educational programmes; and participation in network universities. All these increase the international recognition of educational institutions, contribute to educational services abroad promotion, and increase education exports.

## Results

Taganrog Institute of Management and Economics in Taganrog, Russia has majors in economic sciences and law. Its graduates are highly qualified specialists of a new generation who can easily adapt to the system of market relations, solve legal and financial issues in a modern way, and apply new technologies. International activity is one of the priority areas because it makes possible an exchange of scientific and cultural information, study of country's economic and political structure, and educational space possibilities expansion. With a bachelor's degree graduates can continue studies abroad.

TMEI entered into agreements with foreign educational organizations, including Bergstadt

Gymnasium (Germany), Logos Centar and Center for Business Studies colleges (Bosnia and Herzegovina), Janos Kodolanyi University of Applied Sciences (Hungary). The exchange of students and teachers through the use of joint international projects is very productive for solving assigned tasks in cooperation.

Each of the selected alternatives corresponds to one of the models of higher education internationalization and educational services export described above. Summer courses are the implementation of the export model, visiting professors' lecturing is associated with the import model, online courses implement the e-learning model, and double degree programs are the academic joint venture model (Fig. 7).

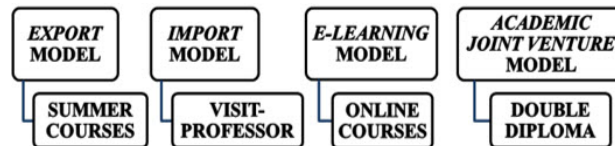


Figure 7. The relevance of the proposed measures and models of internationalization of education

Competencies necessary to comply with the requirements of new tendencies are project activity participation, team-work abilities, systemic thinking, time and process management, decision-making skills, intercultural and interlingua communication, English language oral skills, multifunctional and all-purpose universality in uncertain situations.

All the criteria of the international education successful model are ranked by their importance; the most important is compliance with the national educational policy, less important one is appeal for students and the least important is the cost of one student's training. As the basis for the analysis the criteria of cost, students' number, competences, training time, diploma/ certificate, students' interest, flexibility were taken. These criteria and values are presented in the Table 2.

**Table 2**  
*Description of criteria and their significance*

Criteria	Goal name	Goal weight factor	Normalized weight factor
cost	To minimize cost	4	0,2
students' number	To maximize the number of students	2	0,1
competences	To raise the compliance with the national educational project (competences number)	5	0,25
time	To minimize the time of training /to maximize the training intensity	4	0,2
diploma/ certificate	To increase the importance of diploma, degree or certificate	2	0,1
interest	To maximize the appeal for students	1	0,05
flexibility	To maximize the flexibility	2	0,1
TOTAL SUM		20	1

As it can be seen from the data presented in Table 2, the most important criteria are competencies, costs, and time of training. The least important are interest, students' number and the course flexibility. The description of alternatives is presented in Table 3.

**Table 3**  
*The description of alternatives according to the selected criteria*

Criteria	Summer courses	Visit-professor	Double diploma	Online courses
training cost per 1 student	1600 rub	6000 rub	100000 rub	1000 rub
students' number	15	50	5	50
competences	3 competences	2 competences	4 competences	3 competences
time	40 h/2 weeks	72 h/1 month	6/12 month	72-600 h/ 1-6 month
diploma/degrees/ certificate	certificate	certificate	diploma	certificate/diploma
interest	high	middle	middle	high
flexibility	high	low	low	high

The results are based on the opinions of experts who have had an extensive experience in the sphere of international higher education (over 15 years). In total, 5 experts took part in the study. Data obtained from the experts' analysis are averaged and presented in Table 4.

**Table 4**  
*Pros and Cons Analysis of Educational Models*

Pros	Cons
<b>Cross-border online courses for international students</b>	
using the latest digital and communications technology	long preparatory work
there are no problems of life and leisure of students	costs of the latest hardware and software
no need to change place of residence	additional costs for promoting online courses abroad
distance learning	lack of immersion in the linguistic and cultural environment
<b>Double diploma programs</b>	
two higher education diplomas at the time of receiving one	students are not ready for double study load
world level education	students need to leave home for 1-2 years
individual learning path	long preparatory work (conclusion of contracts, paperwork, etc.)
professional knowledge in different languages	the need to solve domestic problems
<b>Visiting professor invitation</b>	
teacher is a native speaker of a foreign language	embedding a course in a traditional learning system is needed
possibility of informal communication with a foreign teacher	foreign teachers need high salaries
the opportunity to establish international relations with foreign universities	additional costs for adaptation, life and leisure of a foreign teacher
<b>Summer courses</b>	
flexible program	short term
high interest of students	difficult to find teachers for the summer
high intensity	additional costs for providing life and leisure for students
immersion in the linguistic and cultural environment	

For comparison of international education different models' advantages and disadvantages different methods of analysis were applied in our study. The first one is called The Pros and Cons Analysis. It is a qualitative method of analysis comparing positive with negative aspects). Experts in correspondent field compile lists of pros and cons on strengths and weaknesses basis for each alternative.

The second method used to evaluate different models of international education was the Kepner-Tregoe Method used in decision-making activity. It provides assessment criteria for information collection, systematization and evaluation before making a decision. "The Kepner-Tregoe decision-making method based on the ultimate goal of any decision becomes the best choice of possible options, it must be noted that it is the "best", but not ideal in this situation. Despite the comparative analysis of solution options, the risk remains. Using the Kepner-Tregoe matrix reduces the risks associated with making a wrong decision" ([Kepner-Tregoe Portal](#)).

By using Pros and Cons Analysis we show that each international educational model has advantages and disadvantages in its activities. For comparative analysis, it is necessary to identify priority assessment of less important criteria. This can be done with Kepner-Tregoe method (Table 5).

**Table 5**  
*Kepner-Tregoe matrix of Cross-border online courses for international students. Description of factors and their significance*

Criterion	Importance	Description	Score	Total
competences	9	middle	7	63
revenue per 1 student	8	1000-5000 rub	8	64
time	7	72-600 h/ 1-6 month	5	35
flexibility	6	high	9	54
diploma/ certificate	6	diploma/ certificate	5	30
students' number	6	50	10	60
interest	5	high	9	45
cost per 1 student	5	1000 rub	10	50
				<b>401</b>

All the criteria were analysed and evaluated by experts according to their significance. The totals were calculated by multiplying the rank of each criterion by the score of each criterion alternative, as a result total estimates were obtained. The analysis of cross-border online courses programmes results and evaluation are presented in Table 5.

**Table 6**  
*Kepner-Tregoe matrix of Summer courses for international students. Description of factors and their significance*

Criterion	Importance	Description	Score	Total
competences	9	middle	7	63
revenue per 1 student	8	2000 rub	8	64
time	7	40 h/2 weeks	8	56
flexibility	6	high	10	60
diploma/ certificate	6	certificate	2	12
students' number	6	15	7	42
interest	5	high	9	45
cost per 1 student	5	1600 rub	8	40
				<b>382</b>

"To fill in the matrix for each alternative, various digital indicators are determined and the value for each factor is calculated, followed by the weight of each solution. In Kepner-Tregoe analysis each evaluation criterion is first scored based on its relative importance to the other criteria (1 = least; 10 = most)" (Egorova and Makarova, 2020). According to expert evaluation and after different methods application, for foreign students' benefit summer courses (382 points) and cross-border online courses (401 points) were considered the most relevant way of educational services export.

## Discussions

When actual numerical data are unavailable, subjective reasoning, opinions, and/or consensus scoring can be substituted and documented in the final report instead. Research has demonstrated that simplified decision analysis methods (SMART) are robust and replicate decisions made from more complex analysis with a high degree of confidence.

The experts involved in the study were specialists in the field of higher education with extensive experience in higher education institutions (over 15 years). In total, 5 experts took part in the study. All data obtained from experts were averaged and presented in tabular form.

The Simple Multi Attribute Rating Technique (SMART) (Baker et al., 2002) utilizes simple utility relationships and simple scale. Five, seven, and ten point scales are the most commonly used. The

SMART methodology allows using less of the scale range with data not discriminated adequately.

For the basis of the analysis we take the criteria of cost, students' number, competences, training time, diploma/ certificate, students' interest, flexibility. Weighted criteria estimates are summarized in the totals shown in Table 7.

**Table 7**  
*Rank factor estimates of the Simple Multi Attribute Rating Technique (SMART) factors*

Criteria	Summer courses	Visit-professor	Double diploma	Online courses
cost	4	3	1	5
students' number	4	1	1	5
competences	3	2	5	4
time	5	4	1	2
diploma/ certificate	2	1	5	3
interest	4	3	2	4
flexibility	4	2	2	4

A performance rating scale of 1-5 is used when a rating of "1" always means worse performance (0), and a rating of "5" always means better performance (1). The normalized values in Table 3 are converted to usable values from 0 to 1 (1 = 0, 2 = .25, 3 = .5, 4 = .75, 5 = 1.0). Weighted criteria estimates are summarized in the totals shown in Table 8.

**Table 8**  
*Utility values of the Simple Multi Attribute Rating Technique (SMART) factors*

Criteria	Summer courses	Visit-professor	Double diploma	Online courses
cost	0.75	0.5	0	1
students' number	0.75	0	0	1
competences	0.5	0.25	1	0.75
time	1	0.75	0	0.25
diploma/ certificate	0.25	0	1	0.5
interest	0.75	0.5	0.25	0.75
flexibility	0.75	0.25	0.25	0.75
	<b>4,75</b>	<b>2,25</b>	<b>2,5</b>	<b>5</b>
	<b>0,68</b>	<b>0,32</b>	<b>0,36</b>	<b>0,71</b>
	<b>67,9%</b>	<b>32,1%</b>	<b>35,7%</b>	<b>71,4%</b>

The results of calculations are presented in Table 8 and show the highest utility ratings received by two of the alternatives we proposed - summer courses (67.9% utility) and online courses (71.4% utility). Thus, it is necessary to choose summer and online courses as the best alternatives.

After comparative analysis of international educational activities in higher education has been accomplished, summer courses and cross-border online courses have proved to be the most effective and efficient way of getting higher education abroad. To improve the management of international activities, new forms of international student exchange and other options for exporting educational services have been proposed. Pros and Cons Analysis revealed the advantages and disadvantages of the proposed areas of development. Kepner-Tregoe Analysis and Simple Multiple Attribute Evaluation Method allowed evaluating these alternatives by the criteria cost, students' number, competences, training time, education document, interest for students, program flexibility. The most effective ones are summer courses and e-learning programs. Using these forms of international student exchange will attract new foreign students and increase the level of TMEI income from the export of educational services.

## Conclusions

A theoretical analysis of key concepts in the field of international education management has shown that the most significant factor in international education management is the stimulation of all forms of academic mobility. International student exchanges contribute to advancement of educational goods and services in the world market and ultimately lead to the development of the export potential of the RF higher education. Modern programs and models for exporting educational services on the international education market are very diverse, but in modern conditions, universities tend to use most of them, which makes it possible to diversify the educational services market.

In TMEI, international educational activities have been carried out since 1996 according to existing educational programs, students' cultural and educational exchanges, visiting professors, and participation in international scientific and educational events. For the regional private educational organization TMEI, several alternatives were proposed to improve the management of international student exchanges in the export of higher educational goods and services. The organization of short-term summer courses for foreign citizens, the development of programs for cross-border online training, invitation of more foreign visiting professors, and the development of double degree programs were proposed.

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### Conflict of interests

The authors declare no conflict of interest.

## References

- Amirov, R.A. (2018). Eksport obrazovatel'nykh uslug kak vazhneyshiy faktor povysheniya konkurentosposobnosti i ekonomicheskogo razvitiya strany [Export of educational services as the most important factor of Competitiveness and Economic Development of the Country]. *Upravlencheskoye konsul'tirovaniye [Administrative Consulting]*, 8(116), 71-81. <https://doi.org/10.22394/1726-1139-2018-8-71-81>
- Bailey, L., & Cooker, L. (2018). Who Cares? Pro-social education within the programmes of the International Baccalaureate. *Journal of Research in International Education*, 17(3), 228–239. <https://doi.org/10.1177/1475240918816405>
- Baker, D., Bridges, D., Hunter, R., Johnson, G., Krupa, J., Murphy, J., & Sorenson, K. (2002). *Guide to decisionmaking methods. developed for the department of energy, WSRC-IM-2002-00002*, 2. Retrieved from [https://www.researchgate.net/publication/255621095\\_Guidebook\\_to\\_Decision-Making\\_Methods](https://www.researchgate.net/publication/255621095_Guidebook_to_Decision-Making_Methods)
- Barabanova, S.V., Kaybiyaynen, A.A., Kraysman, N.V. (2019). *Digitalization of Engineering Education in a Global Context (Review of International Conferences)*. M.: Higher education in Russia. 1. 94-103.
- Bedenlier, S., Kondakci, Y., & Zawacki-Richter, O. (2018). Two Decades of Research Into the Internationalization of Higher Education: Major Themes in the Journal of Studies in International Education (1997-2016). *Journal of Studies in International Education*, 22(2), 108–135. <https://doi.org/10.1177/1028315317710093>
- Bischof, L. (2014). Franchising, Validation, and Branch Campuses in the European Union. *International Higher Education*, (74), 16-17. <https://doi.org/10.6017/ihe.2014.74.5468>
- Bondarenko, V.V., Zaugarov, V.V., Seleznev, P.S., & Yudina, V.A. (2018). Kontseptsiya sovershenstvovaniya universitetskogo obucheniya inostrannykh studentov v Rossiyskoy Federatsii v ramkakh politiki "myagkoy sily" [The concept of improving university education of foreign students in the Russian Federation in the framework of the policy of "soft power"]. *Gumanitarnyye nauki. Vestnik Finansovogo universiteta [Humanities. Bulletin of the University of Finance]*. 5(35). 6-18. <https://doi.org/10.26794/2226-7867-2018-8-5-6-18>
- Bridges, W. & Bridges, S. (2017). *Managing Transitions, 25th anniversary edition: Making the Most of Change*. Hachette Books. 208.
- Buckner, E. (2017). The Worldwide Growth of Private Higher Education: Cross-national Patterns of Higher Education Institution Foundings by Sector. *Sociology of Education*, 90(4), 296–314. <https://doi.org/10.1177/0038040717739613>
- Cai, Y., & Etkowitz, H. (2020). Theorizing the Triple Helix model: Past, present, and future. *Triple Helix*, 1(aop), 1-38. <https://doi.org/10.1163/21971927-bja10003>
- Dakowska, D. (2017). Competitive universities? The impact of international and European trends on academic institutions in the 'New Europe.' *European Educational Research Journal*, 16(5), 588–604. <https://doi.org/10.1177/1474904116688024>
- EAIE, European Association for International Education: official website. Retrieved from <https://www.eaie.org/>
- Egorova I. A. & Makarova, E.L. (2020). Managerial decision-making analysis for various forms of international educational activities organization in higher education. *Modern Science*. 2-2. 17-23. Retrieved from <https://www.elibrary.ru/item.asp?id=42515313>
- Etkowitz, H. (2016). The Entrepreneurial University: Vision and Metrics. *Industry and Higher Education*, 30(2), 83–97. <https://doi.org/10.1080/09595839.2016.1191111>

- [doi.org/10.5367/ihe.2016.0303](https://doi.org/10.5367/ihe.2016.0303)
- Federal State Statistic Service: official website. Retrieved from <https://rosstat.gov.ru/>
- Gaebel, M., Kupriyanova, V., Morais, R., & Colucci, E. (2014). E-Learning in European Higher Education Institutions, European University Association.
- Gaus, O., & Raith, M. G. (2016). Commercial transfer – A business model innovation for the entrepreneurial university. *Industry and Higher Education*, 30(3), 183–201. <https://doi.org/10.1177/0950422216653197>
- Hawawini, G. (2016). The internationalization of higher education and business schools: A critical review. *Springer*, 85. <https://doi.org/10.1007/978-981-10-1757-5>
- Internet World Stats. Retrieved from <https://www.internetworldstats.com/>
- Ismailova, G., Alma, M., Gulbarshyn, A., Nurgul, B., Sarash, K., & Malik, S. (2020). Determining professional mobility levels of secondary school teachers. *International Journal of Cognitive Research in Science, Engineering and Education*, 8(3), 39-45. <https://doi.org/10.23947/2334-8496-2020-8-3-39-45>
- Kepner-Tregoe Portal Retrieved from <https://www.kepner-tregoe.com>
- Knight, J. (2016). Transnational Education Remodeled: Toward a Common TNE Framework and Definitions. *Journal of Studies in International Education*, 20(1), 34–47. <https://doi.org/10.1177/1028315315602927>
- Knight, J. (2018). International Education Hubs. In: Meusbürger P., Heffernan M., Suarsana L. (eds) *Geographies of the University. Knowledge and Space*, vol 12. Springer, Cham. 637–655. [https://doi.org/10.1007/978-3-319-75593-9\\_21](https://doi.org/10.1007/978-3-319-75593-9_21)
- Makarova, E. A., & Makarova, E. L. (2018). Blending pedagogy and digital technology to transform educational environment. *International Journal of cognitive research in science, engineering and education*, 6(2), 57-66. <https://doi.org/10.5937/ijcrsee1802057M>
- Makarova, E. A., Makarova, E. L., & Hjaltadóttir, R. E. (2019). Analysis of the satisfaction degree of students participating in international educational projects. In *SHS Web of Conferences (Vol. 70, p. 02014)*. EDP Sciences. <https://doi.org/10.1051/shsconf/20197002014>
- Makarova, E. A., Makarova, E. L., & Korsakova, T. V. (2019). The role of globalization and integration in interdisciplinary research, culture and education development. *Journal of History Culture and Art Research*, 8(1), 111-127. <http://dx.doi.org/10.7596/taksad.v8i1.1957>
- Mawer, M. (2017). Approaches to analyzing the outcomes of international scholarship programs for higher education. *Journal of Studies in International Education*, 21(3), 230-245. <https://doi.org/10.1177/1028315316687009>
- Mcvicar, M. (2015). The internationalization of higher education: an emerging political agenda. *Sravnitel'naya politika [Comparative politics]*, 1(18), 82-89.
- Menzies, J. L., & Baron, R. (2014). International postgraduate student transition experiences: The importance of student societies and friends. *Innovations in Education and Teaching International*, 51(1), 84-94. <https://doi.org/10.1080/14703297.2013.771972>
- NAFSA, Association of International Educators: official website. Retrieved from <https://www.nafsa.org>
- OECD/UIS/Eurostat (2019) Retrieved from <https://stats.oecd.org/>
- Pashakhina, E.A. (2020). Rynok obrazovatel'nykh uslug Rossii v usloviyakh reformirovaniya sistemy vysshego obrazovaniya [The market of educational services in Russia in the context of reforming the higher education system]. *Vestnik Tomskogo gosudarstvennogo universiteta. Ekonomika [Bulletin of Tomsk State University. Economy]*. 49, 110-121. <https://doi.org/10.17223/19988648/49/8>
- QS world university rankings (2020). Retrieved from <https://www.topuniversities.com/university-rankings/world-university-rankings/2020>
- Silakova L.V. (2017). Upravleniye transformatsiyey biznes-protsessov sovremennogo universiteta v Rossii. [Transformation management of business processes of a modern university in Russia]. *Voprosy innovatsionnoy ekonomiki [Issues of innovative economy]*. 4. 361-372.
- UNESCO official website. Retrieved from <https://en.unesco.org/>
- Ussenova, A., Malakhova, I., Shmidt, M., Tuliepova, S. ., & Tynyskhanova, A. (2020). Conceptual framework of the model of forming interethnic tolerance in the multicultural environment of the university. *International Journal of Cognitive Research in Science, Engineering and Education*, 8(2), 15-26 <https://doi.org/10.5937/IJCRSEE2002015U>

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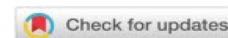
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## Consideration of the Basic Competencies of a Preschool Teacher in Curriculum Modernization

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**Abstract:** The work deals with an important aspect of teacher training — the formation of competence in the field of technologization of the pedagogical process. An updated theoretical model of a holistic pedagogical process is presented, which is the basis for coverage of the criteria for the formation of abilities for the constructive and systematic introduction of technologies into pre-school education. The author's questionnaire The Scale of Self-Assessment of Pedagogical Abilities for the Technologization of the Pedagogical Process was presented. The article provides the results of its testing on a sample of a total of 412 respondents, including 170 preschool teachers with work experience from 1 to 25 years, 200 — students-future teachers, 42 - PEF coordinators. Based on the comparison of samples of teachers with different work experience, it describes how the nature of professional activity determines the specific structure of competences in the field of TPP. The experiment was a part of research; authors showed the conditions for the implementation of a special curriculum, which helps effectively prepare teachers for the use of modern educational technologies.

**Keywords:** pedagogical technologies, professional competences of the teacher, methodological competence, preschool education.

### Introduction

The active development of alternative forms and models of education has led to stricter requirements for its quality. The technological approach assumes a focus on clear measurable goals of the pedagogical process, which are recorded in educational standards and programs (in our case the reference point is the competence model of the teacher of a preschool educational institution). It is in accordance with the model of competencies the optimal algorithm of pedagogical actions is selected: techniques, methods, forms and means of monitoring outcomes. The main advantages of the technologization of the pedagogical process (hereinafter referred to as the TPP) are that this approach guarantees the quick achievement of the intended tasks, regardless of who is the object and subject of the pedagogical influence and under what conditions it occurs. The extraordinary diversity of existing technologies allows us to creatively model the pedagogical process, flexibly adapting it to the capabilities of an educational institution and the needs of learners. In addition, the technological approach is a necessary condition for the effective and safe implementation of innovations in teaching practice. It is thanks to the clear algorithmization of actions and the gradual monitoring of the achievement of results that teachers can implement innovative practices, bearing in mind the responsibility towards children and their families. Thus, the quality of modern education largely depends on the ability of qualified teachers to technologize the pedagogical process.

The pedagogical skill is determined by how much teacher is able to find an effective technological solution for the optimal development of personal qualities and life skills of a learner. Accordingly, the formation of teachers' abilities to effectively use technology in training and education is an important part of vocational training. The fundamentals of this work are laid in the theory of the holistic pedagogical process (Khmel, 2008; Slastenin, 2005), competence-oriented approach (Enygin et al., 2018; Khutorskoy, 2017; Seryakova, 2016), a system analysis of pedagogical communication (Zarudnaya et al., 2018). The reform of higher pedagogical education in the Republic of

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Kazakhstan is accompanied by the work of many scientists: the structure of professionally significant qualities of a teacher is determined (Uspanov, Zhansugirova and Bissenbayeva, 2013); summarised the long-term experience of technologization of the educational process of universities (Kovzhasarova, Nurakhmetov and Aulbekova, 2005); the conceptual framework for the modernization of teacher education has been formulated (Praliev et al., 2015).

The reform of the education system faces the task of preparing a “new time teacher” who is able to train and educate a “new time person”. Comprehensive lists of competencies recognised as necessary in educational systems in different countries are offered by Baumert and Kunter (2013), Blömeke (2017), Thrupp (2006). In addition to subject qualifications, the teacher is expected to be motivated, active in social communications, creative and able to act in uncertain situations. Modern researchers (Pankova, Luzan and Sergeeva, 2016; Sánchez-García et al., 2013) indicate a willingness to innovate and a high level of knowledge of information and communication technologies as a universal attribute of teacher qualifications.

Basic training requirements are presented in a number of academic standards: knowledge of various scientific approaches and methodologies in the field of professional specialization; the ability to use a wide range of techniques, to adapt them for creative problem solving; critically assess the short-term and long-term consequences of their actions (Bologna Working Group, 2005); the presence of an integrative understanding as a basis for the original development or application of ideas (Ministry of Education and Science of the Republic of Kazakhstan, 2018). The concept of higher pedagogical education of the Republic of Kazakhstan (Ministry of Education and Science of the Republic of Kazakhstan, 2005) identifies three groups of competences that a new formation teacher should possess: general cultural, subject-oriented and methodological (psychological-pedagogical). The concept methodological competence of the teacher seems extremely important and requires clarification. Măță et al, (2010) offer an operational model consisting of five components: ensuring the functionality of the educational process, the use of various teaching methods and tools in a formal and informal context, the exploitation of educational innovations, the management of learning outcomes, the design of teaching activities.

The professional competencies of teachers are not limited to the knowledge of current educational methods and programs. It is extremely important the ability to reasonably select and flexibly adapt existing technologies to the changing demands of the society. We called this complex of knowledge and skills “the ability to technologize the pedagogical process” and consider it as one of the main professional competencies of a teacher. The generally accepted understanding the concept of competence implies the ability to use acquired knowledge and skills in a wide range of standard and non-standard pedagogical situations (Mulder, 2014). Accordingly, **competence in the field of TPP** presupposes the ability of the teacher to independently apply various elements of pedagogical technologies under certain conditions of interaction for realizing the specific goal of training and education. Recent large-scale studies have shown a close relationship between the level of development of competencies in the field of TPP and the professional and personal growth of teachers, as well as satisfaction with the profession (Kuanysheva et al., 2019).

In spite of the developed theoretical and methodological basis, the TPP does not pay enough attention to the professional training of teachers in the preschool education system. Technologies are most often learned at the level of knowledge, and not at the level of competence. As a result, the teacher today is still perceived in society as a transmitter of information, and not as an active creator of purposeful pedagogical interaction. In addition, the pedagogical process is in constant development, being modernised in view of the accumulated experience. Accordingly, objective transformations are taking place in the system of professional qualities and competencies, which requires more careful study. In view of the events of 2020, which forced educational systems at all levels to switch to distance learning, this problem is becoming even more acute.

Listed above objective problems and contradictions make relevant the purpose of this publication – to determine the individual abilities of teachers in the technologization of the pedagogical process in the conditions of preschool preparation. The research is aimed at solving the following topical issues: 1) What is the real level of competence of preschool teachers in the field of TPP? 2) How does the structure of competencies depend on the specifics of professional activity? 3) What are the most effective ways to acquire and improve the competence of teachers in the field of TPP?

Practical work is based on the author’s theoretical model, which has been introduced into the preschool education system of the Republic of Kazakhstan more than ten years ago. The results of many years of practice have proved its effectiveness and allowed presenting it in a more current modification (Aubakirova, 2011a; 2011b).

### Author's model of the technologization of pedagogical process

We consider the holistic pedagogical process as a systemic category, the constituent elements of which are the following: conditions of education; relationships in the system “teacher-learner”; common goals and particular learning objectives; the content of training, which is implemented in specific means of pedagogical interaction; organization and management of the educational process; ways of consistent monitoring of performance.

The structural elements of the pedagogical process are closely interrelated and together represent a dynamic cycle (Figure 1).

The pedagogical process begins with the organization of a harmonious personality-oriented interaction in the system “Teachers – Pupils” (as well as “Teachers-Parents”, “Pupils – Pupils”). Purposeful regulation requires timely diagnostics, analysis of these relationships as a part of a holistic pedagogical process. Next, the teacher formulates the urgent tasks of interaction and expediently models the pedagogical process. The main pedagogical goals and the content of education are determined by external factors: the needs of society are worked out by the pedagogical community and are embodied in curricula and educational standards. Acting within this framework (as well as using the resources of a particular educational institution), the teacher is free in the means of realization – in what way the direct pedagogical interaction will be realised. At this stage his professional skills and pedagogical culture are realised to the greatest extent. Systemic management of the pedagogical process implies constant, phased control and timely correction of the used technology. The pedagogical cycle ends with an analysis of the results: in the context of the tasks set for the development of learners, the effectiveness of using a particular technology in these conditions, their own professional actions and their consequences. This allows you to simulate a new pedagogical task at a new level of relationships.

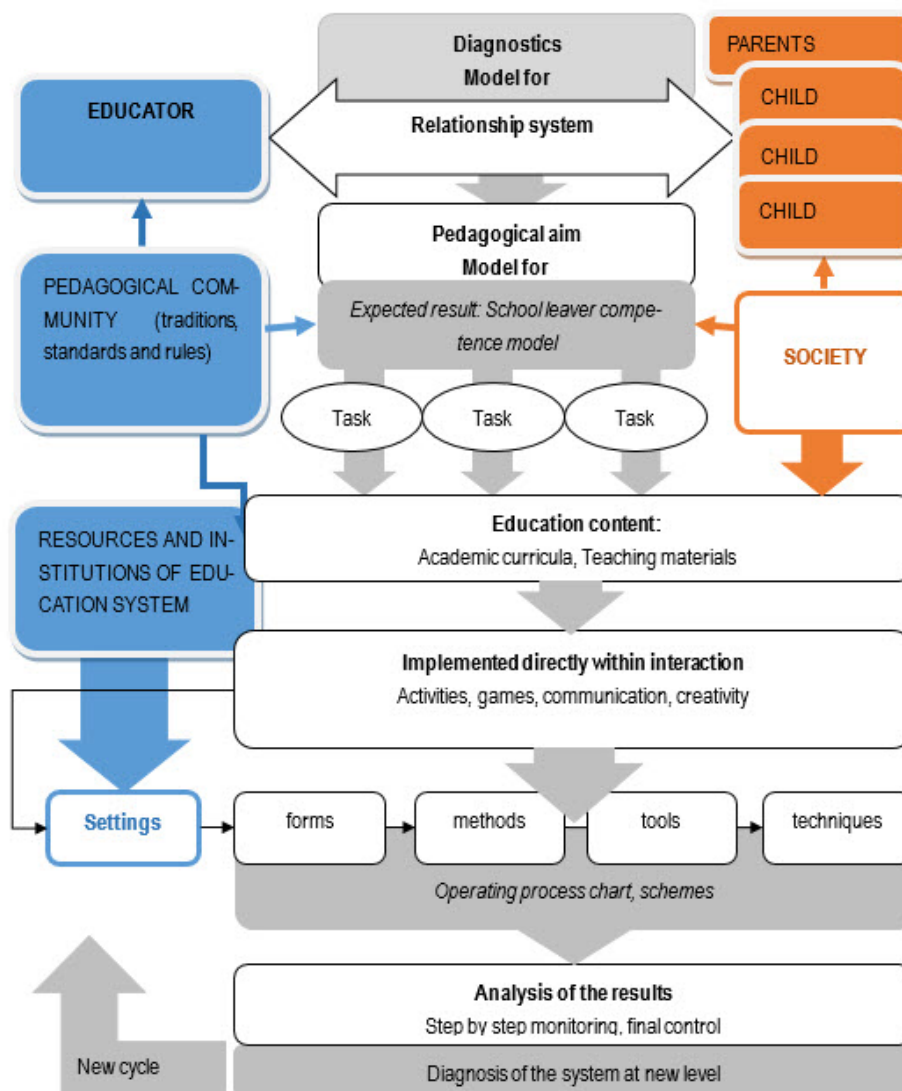


Figure 1. Structural components of the pedagogical process

Based on the presented model, we formulated the **structural criteria for the formation of pedagogical competence in the field of TPP:**

(1) Establishment of pedagogically expedient relations. This criterion includes the following components:

A) The ability to timely and accurately diagnose relationships in the system of pedagogical interaction.

B) Knowledge of techniques and the ability to regulate the interaction in the educational mechanisms of the ECE pedagogical process.

C) Purposeful self-improvement of the teacher based on the reflection of their own professional growth and personal qualities.

(2) Modelling the pedagogical process:

A) Awareness of the unity of the various goals and objectives of educational activities.

B) Forecasting and design of the pedagogical process in accordance with the tasks of the development of preschoolers.

C) Planning of educational activities in the framework of the approved curriculum and the specific conditions for their implementation in an educational institution.

(3) The implementation of the pedagogical process:

A) The implementation of the content of education in the context of the objectives and current tasks.

B) Knowledge of effective means, forms, methods and techniques, the ability to apply them in direct work with preschoolers.

C) Creative design of the pedagogical process when changing conditions and situations of interaction.

(4) The organization and management of the pedagogical process is associated with the constant monitoring of the flow of the pedagogical process, the ability to take into account the factors that impede or stimulate its implementation:

A) Phased monitoring of the implementation of the pedagogical process at each stage and in each element, the ability to make adjustments.

B) Tracking of pedagogical innovations.

(5) The analysis of the implemented technology occurs systematically throughout the whole pedagogical cycle and includes:

A) Analysis of the initial data and conditions of a specific pedagogical situation.

B) Understanding the pedagogical goal and tasks at each stage and in each element of the pedagogical process.

C) Further transformation of technology, taking into account the corrections made to improve the holistic educational process.

## Materials and Methods

The main method of obtaining information on the formation of pedagogical competence in the field of TPP is self-analysis of pedagogical activity, which implies a well-developed reflection and ability for self-observation of the teacher. We have developed a self-reporting methodology based on the criteria set forth above. The scale is a screening tool that provides data on the level of development of pedagogical competence (as a construct of knowledge, skills and attitudes) in the field of TPP. This allows evaluating the effectiveness of educational and training programs aimed at developing the appropriate qualities of teachers.

To measure the level of development of each component, we employed a 5-point scale, where its extreme poles indicated the lack of competence (0 points), and its maximum severity (4 points):

0 – the ability is not expressed;

1 – the ability manifests itself sporadically, quite rarely;

2 – the ability to manifest itself occasionally, from case to case;

3 – the ability to manifest itself frequently, in most cases.

4 – the ability to manifest itself consistently, almost always.

To obtain the total score we summed the scores for all 13 items. In addition to calculating the total score, the analysis of answers to individual questions and blocks of the scale allows to draw conclusions about the structural components (abilities) in the implementation of educational technologies. Thus, we have the opportunity to create an individual profile of the abilities of a specialist to identify the leading components and potential possibilities that need to be improved.

Processing and interpretation of the estimates obtained was based on a direct interpretation of the average score, based on the values of the proposed 5-point Likert scale. We consider 1.5-2.5 points as an average level of competence - ability sometimes manifests itself, from case to case. In this case, we can talk not about a stable explicit tendency (towards the manifestation of competence or its absence), but about the fact that the ability is realized in certain pedagogical situations that contribute to its manifestation. The excess of this factor indicates the intensity of abilities and skills, a decrease indicates the insufficient formation of competences in the field of TPP.

The sample was formed from "natural" socio-professional groups — teachers with different specializations, work experience and level of professional skills:

(1) bachelors majoring at Preschool Education of the Semipalatinsk State Pedagogical Institute and the Shakarim State University in Semey (162 people);

(2) masters majoring at Pedagogy and Methods of Elementary Education of the Semipalatinsk State Pedagogical Institute, 38 people,

(3) 170 preschool teachers in Semey, who undergo refresher courses (we divided the sample into two subgroups: with work experience up to 10 years and from 11 to 25 years);

(4) methodologists of preschool educational institutions, PEF coordinators - participants of seminars of international project TEMPUS EDUCA JEP 517504 at Shakarim State University (42 people)

Participation in the study was voluntary. All respondents gave their consent to the processing and use of personal data.

According to the results of diagnostics, we calculated descriptive statistics. An assessment of the individual points of the scale in different samples was also carried out – thus conclusions were made about the structure and dynamics of the formation of individual components of teachers' competence in the field of TPP.

Considering that a teacher should be an expert in a wide range of methodological areas and be ready for introduction of innovative educational technologies, we have developed a special training course "Modern educational technologies in the system of a teacher's professional activities" (in collaboration with A. Magauov and Sh. Duisembekov). The objectives of the course: to reveal the essence of educational technologies; to form the ability of teachers to use them in practice; to promote the development of a creative and constructive approach to teaching. The material of the special course is organized in three modules: Education technology conceptual basis, Personalities of a teacher and learners in the education technologies system, Didactic design of education technologies. The volume of material includes 14 hours of lectures, 10 hours of seminars, 6 hours of practical training.

The program has been tested on a selection of undergraduates in the specialty Pedagogics and Primary Education Methodology at the Semipalatinsk State Pedagogical Institute (two groups with a total of 38 people). A teaching experiment was organized as follows: in the experimental group, the course was introduced during the first semester of the school year, in the control group it was transferred to the schedule of classes in the second semester. Thus, we were able to record the results of the implementation of the curriculum and analyse its impact on the formation of competences in the field of TPP.

For starting and final measurements the self-assessment scale of pedagogical skills for the TPP presented above was used. Sample rates were calculated for different professional groups, the reliability of measurements was verified. Inferential statistics were used in addition to descriptive statistics. Statistical analysis was performed using the nonparametric tests that allow comparing small groups and ignoring deviations from the normal distribution: Wilcoxon T-test for measuring the shift in values as a result of training, and Mann-Whitney U-test for comparing control and experimental groups.

## Results

### 1. Identification of the formation of the ability to technologise the pedagogical process among teachers of the preschool education system

First of all, we have calculated the total score of the self-assessment scale of abilities for the TPP. These data are the basis for the development of group test standards in evaluation of the studied abilities in different selections – Table 1.

**Table 1**

*Data descriptive statistics of the total score of the scale of self-assessment of the abilities of the TPP the selections of teachers with different experience*

No	Selection of teachers:	N	data interval (min-max)	M	SD	SE
1	bachelors – prospective teachers	162	7-24	14,55	3,44	0,27
2	masters – prospective teachers	38	8-25	16,86	4,16	0,67
	teachers/educators of PEF (preschool educational institutions):	170	11-34	22.65	4.28	0.32
3	- track record 1-10 years	72	10-28	19.66	3.30	0.38
4	- track record 11-25 years	98	13-34	25.65	4.27	0.43
5	PEF coordinators	42	17-29	23.71	2.55	0.43

Selected rarely give themselves a score above 2 points. This indicates a lack of capacity development in the field of TPP. We see that teachers and practitioners with experience of more than 10 years are most confident in their competence in application of educational technologies. Approximately the same average results show selected teachers with experience of 1-10 years and methodologists of preschool institutions. At the same time, in the selection of methodologists, the smallest data scattering is that none of the respondents showed a low level of parameter expression. It is expected that the lowest indicators of the formation of pedagogical abilities in TPP were found among students – future teachers (bachelors have lower rates more often than masters).

The calculated Cronbach's Alpha was 0.895, which indicates a high internal consistency of the scale.

The distribution of estimates for individual points of the scale in different selected people is in some way interesting. Table 2 presents the average arithmetic for questions.

**Table 2**  
Average estimates of individual criteria for pedagogical abilities for the technologization of the pedagogical process in different selected persons

No	Criteria of evaluating pedagogical competence in the field of TPP	Average marks of selected teachers*					Lsd. (N=412)
		1	2	3	4	5	all
1	Able to timely and accurately diagnosing relations in "educator – learners" system	0.8	0.9	1.4	1.8	1.8	1.37
2	Able to adjust the interrelating mechanisms of the education process	0.9	1.1	1.8	2.2	2.1	1.48
3	Make constant efforts for self-improvement both personal and professional one	1.7	1.9	1.5	1.9	1.8	1.83
4	Aware of the common purpose of the education process, able to single out concrete tasks for implementation	1.6	1.9	1.6	2	2.2	2.01
5	Able to project pedagogical interrelation and able to forecast the results of application of technologies	2.2	2.2	2	2.2	2.4	2.35
6	Now how to reach the needed results in specific conditions of activity	1.5	1.5	1.8	2.2	2.6	1.99
7	Select and apply affective means and technic of the pedagogical interrelations	1.2	1.7	2.1	2.8	2.2	2.04
8	Adjust and make up creatively the teaching process, in course of change of the educating situation conditions	0.9	1.1	1.8	3.1	1.9	1.60
9	Control the education process at each stage and each element makes corrections	1.3	1.4	1.6	1.8	1.5	1.41
10	Master the ways to organise pedagogical activities in scientific manner	0.5	0.6	0.7	1	1.1	0.95
11	Analyse the inputs and conditions of a specific pedagogical situation	1	1.2	0.8	1.1	1.2	0.97
12	Able to think over each aim and task at every stage of education process	0.7	0.8	1.1	1.3	1.6	1.16
13	Able to transform and to adjust the technologies in order to improve the comprehensive educating process	0.2	0.5	1.5	2.2	1.4	1.08

\*The numbering of the selected people is as follows: 1 – bachelors; 2 – masters, 3 – teachers with experience of 1-10 years; 4 – teachers with experience of 11-25 years; 5 – preschool methodologists.

Based on the data obtained, the most problematic components of the TPP among teachers are proficiency in the methods of scientific organization of pedagogical work (paragraph 10, Lsd=0.95), analysis of the initial data of a particular pedagogical situation (p.11, Lsd=0.97) and transform technologies to improve the holistic pedagogical process (p.13, Lsd=1.08). The respondents use these competencies and abilities extremely rarely, or do not use them at all. The construction of expedient activities requires more close attention, that is, an understanding of the pedagogical goals and objectives in each element of the educational process (p.12, Lsd=1.16).

In general, the results show a lack of ability to system analysis of the entire pedagogical cycle in the general structure of pedagogical competence in the field of TPP.

When analysing the estimates of points, the specificity of different selected people is clearly visible:

- Bachelors have lower marks on most points of the scale compared to masters. In general, the future teachers are characterised by insufficient formation of the ability to establish pedagogically expedient relations with pupils. Interestingly, they overestimate their abilities to analyse the initial data of the pedagogical situation, to design the pedagogical process and to predict the result (p.5 and p.11 of the

scale is the average assessment at the level of teachers with work experience of over 10 years).

- Young teachers with experience from 1 to 10 years are less than the rest make efforts for continuous personal and professional improvement (p.3, Lsd=1.5). In this group, the lowest estimate of the ability to design the pedagogical process according to the set goal and predict its results was obtained (p.5, Lsd=2.0). Estimates of the remaining pedagogical abilities are significantly increased compared with the students, but less pronounced than in the group of experienced teachers.

- Experienced teachers with work experience 11-25 years demonstrate the highest ability to regulate the interaction between the participants of the holistic pedagogical process (p.2, Lsd=2.2); to the effective selection and application of training and education facilities (p.7, Lsd=2.8); to the transformation of the technologies used (p.13, Lsd=2.2). A distinctive feature of the selection is a flexible, adaptive and creative design of the pedagogical process taking into account the real conditions of the pedagogical situation. It is this ability that they note as the most frequently used in the work (p. 8, Lsd=3.1).

- Methodologists of preschool institutions have a characteristic structure of abilities, in which the component of the modeling the pedagogical process prevails. They realize the goals and objectives of the pedagogical process better than all the other categories of specialists, and accordingly design it (p.4, Lsd=2.2); know what means to effectively implement the content of education (p.6, Lsd=2.6); able to predict the results of the application of technology in specific conditions of activity (p.5, Lsd=2.4). The whole range of pedagogical competencies in the field of TPP is developed at a fairly high level. Slightly lagging behind is the possession of the methods of the scientific organization of pedagogical work (p.10, Lsd=1.1).

The data obtained clearly demonstrate how the specificity of professional activity influences the development of individual components of the competence of teachers in the field of TPP. In addition, we found out the role of vocational training in the formation of these abilities.

## 2. Formation of abilities and competencies of teachers based on the concept of technologization of the pedagogical process

Formative influence occurred in the selection of masters, who during the 30 academic hours mastered the special course “Modern educational technologies in the system of professional activity of a teacher.” The diagnostic results in the control and experimental group are presented in Table 3.

**Table 3**

*Statistical significance of differences in the level of ability to technologize the pedagogical process in the experimental and control groups*

	N	M	SD	Sum of Ranks	U Mann-Whitney	Asymp.Sig. (2-tailed)
Primary diagnosing						
Control group	19	14.89	3.71	361.5	171.5	0.790
Experimental group	19	14.94	4.07	379.5		
Secondary diagnosing (after the training)						
Control group	19	15.05	3.64	288	98	0.014
Experimental group	19	17.58	4.44	453		

The level of the studied phenomenon in the experimental and control groups during the initial diagnosis was the same. In the control group, we observe a slight increase in the indicator due to the natural development of professionalism of future teachers in the process of training in the magistracy. At the same time, the level of development of competencies in the experimental group significantly increased after passing the training course. As a result, the groups began to differ significantly in the value of the parameter ( $p = 0.014$ ). After the experiment, the general level of abilities to the TPP in the experimental group exceeds the level in the control group.

Following the principle of phased control of the results of the use of educational technology, we carried out diagnostic measurements at each stage of the formative experiment. This allowed us to trace the dynamics of changes in abilities to the TPP (Figure 2).

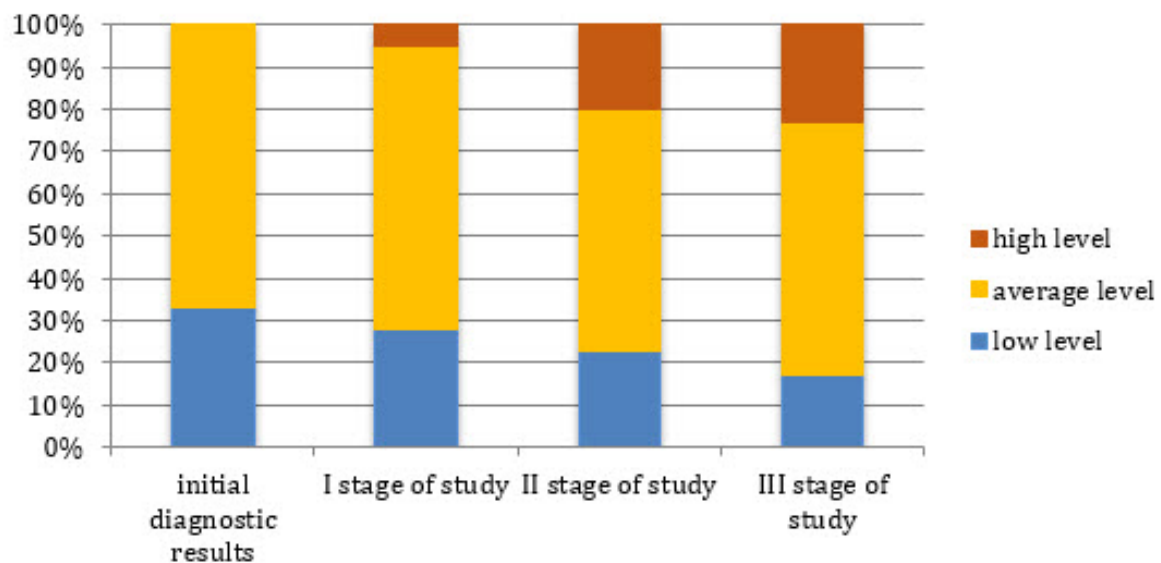


Figure 2. State of competency of the investigated phenomenon in experimental group (N=19, in %)

As a result of the training course in the experimental group, the number of teachers with high self-esteem in the field of TPP gradually grew. At the end of the experiment, it reached 23%. It is important that the greatest increase occurs at the second stage of training, when practical exercises begin using active technologies. At the same time, the number of teachers with a low level of competence decreased from 33 to 17%.

Thus, as a result of mastering the special course “Modern educational technologies in the system of a teacher’s professional activity”, future teachers have the pronounced positive dynamics in the formation of competences in the field of TPP.

## Discussions

Approbation of the questionnaire “The scale of self-assessment of pedagogical abilities for the technologization of the pedagogical process” showed high internal consistency of items, which indicates the reliability of the measurement. The common basis for the set of questions also indirectly confirms the proposed theoretical model of the TPP criteria. Analysis of means confirmed assumption that the professional competencies of preschool teachers are insufficiently developed.

An important result concerns the relatively low indices of abilities to the TPP among young teachers compared with university graduates. This fact can be explained with the help of the Daning-Kruger rule on metacognitive distortion, as a result of which specialists with low qualifications make erroneous conclusions about their own capabilities to design and regulate pedagogical interaction. Facing real professional situations, young teachers are aware of their own limits and mistakes, as a result of which the self-assessment of competencies decreases. In the group of experienced teachers, the high grades reflect an objective growth of professional skills.

The data of [Hoy and Spero \(2005\)](#) confirm the increase in self-efficacy during the training of future teachers. Therefore, when introducing professional development programs, one should pay attention to the adequacy of teachers’ self-assessment and develop their ability to self-knowledge. Undoubtedly, knowledge of their potential internal resources, abilities and limitations determines the increase in responsibility and the desire of teachers to actively participate in their own development. Thus, the nature of the professional activities of teachers determines the structure of competences in the field of TPP. The ability to constructively use pedagogical technologies can be purposefully developed, which is confirmed by the results of a teaching experiment. Among modern ways to improve the pedagogical process, the theory and methodology of pedagogical innovation should be noted ([Hannan, 2005](#); [Walder, 2014](#)), the introduction of public distance learning, e-learning ([Bidin and Ziden, 2013](#); [Fominykh et al., 2016](#)); defining the teacher’s ethical profile ([Jeder, 2013](#)).

A characteristic feature of the dynamics of the formation of skills in the process of mastering the special course is the practical orientation of the activity. Opinion about the importance of the workshop in

teacher training has been repeatedly expressed in pedagogical science and found numerous empirical evidences. It is necessary to recognise that the process of teaching practice needs more thorough structuring and technologization. In the preparation of teachers, it is necessary to focus on the ability to design the pedagogical process in accordance with actual tasks. In addition to clear target orientations of vocational education, it is important to use precisely those methodical techniques and practices that teachers will later implement in the training of children. We believe that this is the most optimal and effective way to show how the technology works, to reveal its advantages and limitations, to finally form methodological competence of teachers.

## Conclusions

Surveyed Kazakhstan's preschool teachers are not confident enough in their abilities and competencies in the field of technologization of the pedagogical process. The indicators of self-assessment of pedagogical abilities for the technologization of the pedagogical process increase with increase of the level of education and professional experience.

The structure of abilities differs significantly among teachers with different work experience. The position of methodologists implies assistance to teaching staff in the specification of the content, methods and means of training. They often develop information and teaching materials and rarely communicate directly with children and parents. This imposes a specific imprint on the structure of competences in the field of TPP (the predominance of the components of the educational process modelling). Methodologists significantly lag behind practicing educators in their ability to adaptively design the pedagogical process, to select effective methods and techniques in a real situation of interaction. That is, the transformation of technology, their creative application occurs in practice, with the accumulation of experience working with various techniques. This is important to consider in order understanding the nature of innovation.

To reach an adequate level of these qualities, it is necessary to provide special training, which necessarily provides for the use of active teaching methods (acquiring relevant attitudes, knowledge, and approbation of skills). Particular attention in this issue should be paid to a system analysis of a holistic pedagogical cycle, an understanding of pedagogical goals in each element of the educational process, as well as the ability to transform existing technologies to achieve the set objectives. The competences further improve directly in the professional activity, in solving real pedagogical problems, and conscious self-development.

## Limitations

Although the problems described are of a global nature, the empirical results obtained refer to the surveyed Kazakhstan's preschool teachers and students. We expect a change in trends in the process of gradual reform of the system of professional training of teachers.

## Appendix A

*Scale of self-assessment of pedagogical abilities for the technologization of the pedagogical process (stimulus material)*

*Instructions: You are offered a number of questions that relate to the ability to practical implementation of various educational technologies in the educational process. Remember your individual experience and evaluate how often this or that ability manifests itself in your work.*

No	Self-Reporting Points	Rating Scale				
1	I am able to diagnose in time and accurately the relationship in the system "teacher-pupils"	0	1	2	3	4
2	I am able to regulate interactions in the educational mechanisms of the pedagogical process	0	1	2	3	4
3	I make a focused effort to continually self-improve, both personally and professionally	0	1	2	3	4
4	I realize the general goal of the pedagogical process, I can identify specific tasks for its achievement	0	1	2	3	4
5	I am able to design pedagogical interaction according to the set goal, I predict the result of using particular technology	0	1	2	3	4
6	I know how to implement the content of education in specific conditions of activity	0	1	2	3	4
7	I select and apply effective means, forms, methods and techniques of pedagogical interaction	0	1	2	3	4
8	I creatively adapt, construct the educational and educational process when the initial conditions of the pedagogical situation change	0	1	2	3	4
9	I exercise control of the pedagogical process at each stage and in each element, making adjustments	0	1	2	3	4
10	I possess the methods of scientific organization of my pedagogical work	0	1	2	3	4
11	I analyse the initial data and conditions of a specific pedagogical situation.	0	1	2	3	4
12	I interpret the pedagogical goal and tasks at each stage and in each element of the pedagogical process	0	1	2	3	4
13	I am able to transform and adapt technologies in order to improve the pedagogical process	0	1	2	3	4

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### Conflict of interests

The authors declare no conflict of interest.

## References

- Aubakirova, R. Zh. (2011a). Модель технологизации педагогического процесса в условиях дошкольной подготовки [Model of technologization of the pedagogical process in the context of preschool training]. *Вестник СГПИ*, 1(21), 19-26.
- Aubakirova, R. Zh. (2011b). Результаты опытно-экспериментальной работы по технологизации педагогического процесса в условиях дошкольной подготовки [The results of experimental work on the technologization of the pedagogical process in the context of preschool training]. *Мир науки, культуры, образования*, 3, 188-190. Retrieved from <https://cyberleninka.ru/article/n/rezultaty-opytno-eksperimentalnoy-raboty-po-tehnologizatsii-pedagogicheskogo-protsessa-v-usloviyah-predshkolnoy-podgotovki>
- Baumert, J., & Kunter, M. (2013). The COACTIV model of teachers' professional competence. In *Cognitive activation in the*

- mathematics classroom and professional competence of teachers* (pp. 25-48). Springer, Boston, MA. [https://doi.org/10.1007/978-1-4614-5149-5\\_2](https://doi.org/10.1007/978-1-4614-5149-5_2)
- Bidin, S., & Ziden, A. A. (2013). Adoption and application of mobile learning in the education industry. *Procedia-social and behavioral sciences*, 90, 720-729. <https://doi.org/10.1016/j.sbspro.2013.07.145>
- Blömeke, S. (2017). Modelling teachers' professional competence as a multi-dimensional construct. In S. Guerriero *Pedagogical Knowledge and the Changing Nature of the Teaching Profession* (pp. 119-135). Paris: OECD Publishing. Retrieved from [http://www.iep.edu.gr/images/IEP/EPITIMONIKI\\_YPIRESIA/Epist\\_Grafeia/EU\\_Policy/2017/2017-05-11\\_OECD-Pedagogical-Knowledge.pdf](http://www.iep.edu.gr/images/IEP/EPITIMONIKI_YPIRESIA/Epist_Grafeia/EU_Policy/2017/2017-05-11_OECD-Pedagogical-Knowledge.pdf)
- Bologna Working Group. (2005). *A framework for qualifications of the European higher education area. Bologna Working Group Report on Qualifications Frameworks* (Copenhagen, Danish Ministry of Science, Technology and Innovation). Retrieved from [http://ecahe.eu/w/index.php/Framework\\_for\\_Qualifications\\_of\\_the\\_European\\_Higher\\_Education\\_Area](http://ecahe.eu/w/index.php/Framework_for_Qualifications_of_the_European_Higher_Education_Area)
- Eferova, A. R. (2018). Methodological Approaches to University Instructors Professional Foreign Languages Competence Development. *The Journal of Social Sciences Research*, (S5), 375-381. Retrieved from <https://www.eibrary.ru/item.asp?id=37528028>
- Enygin, D. V., Fominykh, N. I., Bubenchikova, A. V., Arregi-Orue, J. I., & Aubakirova, R. (2018). To the definition of the notion, multicultural educational environment". *Astra Salvensis*, 1(11), 601-616. Retrieved from <https://www.ceeol.com/search/article-detail?id=667201>
- Fominykh, N., Barsova, O., Zarudnaya, M., & Kolomyitseva, N. (2016). Approaches to prospective economists professional foreign language training in computer orientated language learning environment. *International Journal of Environmental and Science Education*, 11(18), 12067-12083. Retrieved from [http://www.ijese.net/makale\\_indir/IJESE\\_1666\\_article\\_584690a849db0.pdf](http://www.ijese.net/makale_indir/IJESE_1666_article_584690a849db0.pdf)
- Hannan, A. (2005). Innovating in higher education: contexts for change in learning technology. *British Journal of Educational Technology*, 36(6), 975-985. <https://doi.org/10.1111/j.1467-8535.2005.00568.x>
- Hoy, A. W., & Spero, R. B. (2005). Changes in teacher efficacy during the early years of teaching: A comparison of four measures. *Teaching and teacher education*, 21(4), 343-356. <http://dx.doi.org/10.1016/j.tate.2005.01.007>
- Jeder, D. (2013). Teachers' ethic responsibilities in the practice of education and training. *Procedia-Social and Behavioral Sciences*, 92, 432-436. <https://doi.org/10.1016/j.sbspro.2013.08.697>
- Khakimhan, U., Kuljaisha, Z., & Zhanat, B. (2013). Professionally important qualities inherent in a teacher—A measure of rationality regarding pedagogical processes. *Procedia-Social and Behavioral Sciences*, 89, 751-755. <https://doi.org/10.1016/j.sbspro.2013.08.927>
- Khmel, N. D. (2008). *Теория и технология реализации целостного педагогического процесса* [Theory and technology of the implementation of a holistic pedagogical process]. Алматы: КазНПУ им. Абая.
- Khutorskoy, A. V. (2017). Методологические основания применения компетентного подхода к проектированию образования [Methodological foundations for applying the competence approach to designing education]. *Высшее образование в России*, 12, 85-91. Retrieved from <https://cyberleninka.ru/article/n/metodologicheskie-osnovaniya-primeneniya-kompetentnogo-podhod-k-proektirovaniyu-obrazovaniya>
- Kovzhasarova, M. R., Nurakhmetov, N. N., & Aulbekova, G. D. (2005). *Технологизация учебного процесса: казахстанский опыт* [Technologization of the educational process: Kazakhstan experience]. Алматы: Зият-Пресс.
- Kuanysheva, B. T., Aubakirova, R. Z., Pigovayeva, N. I., & Fominykh, N. I. (2019). Technologization of the Pedagogical Process as a Teacher Self-Improvement Factor. *Journal of Social Studies Education Research*, 10(3), 404-433. <https://files.eric.ed.gov/fulltext/EJ1229395.pdf>
- Măță, L., Dumitriu, C., Dumitriu, G., Timofti, I., & Stanciu, M. (2010). Operational model for the development of methodological competences at beginning teachers. *Lucrări Științifice. Seria Agronomie*, 53(2), 335-338. Retrieved from [http://www.uaiasi.ro/revagrois/PDF/2010\\_2\\_337.pdf](http://www.uaiasi.ro/revagrois/PDF/2010_2_337.pdf)
- Minister of Education and Science of the Republic of Kazakhstan. (2018). *Об утверждении государственных общеобязательных стандартов образования всех уровней образования* [On approval of state educational standards of all levels of education]. Retrieved December 6, 2019, from [https://online.zakon.kz/Document/?doc\\_id=33329539#pos=0;0](https://online.zakon.kz/Document/?doc_id=33329539#pos=0;0)
- Ministry of Education and Science of the Republic of Kazakhstan. (2005). *Концепция высшего педагогического образования Республики Казахстан* [The concept of higher pedagogical education of the Republic of Kazakhstan]. Retrieved December 6, 2019, from [https://online.zakon.kz/Document/?doc\\_id=30020913#pos=6;-56](https://online.zakon.kz/Document/?doc_id=30020913#pos=6;-56)
- Mulder, M. (2014). *Conceptions of professional competence*. In *International handbook of research in professional and practice-based learning* (pp. 107-137). Springer, Dordrecht. [https://doi.org/10.1007/978-94-017-8902-8\\_5](https://doi.org/10.1007/978-94-017-8902-8_5)
- Pankova, G. V., Luzan, M. M., & Sergeeva, M. A. (2016). Развитие профессиональной компетентности педагога ДОО в контексте ФГОС ДО и ПС (Профстандарта) [The development of professional competence of a teacher of secondary education in the context of the Federal State Educational Standards for Subsidiaries and teaching staff (Profstandard)]. *Научно-методический электронный журнал "Концепт"*, 10, 231-235. Retrieved from <http://e-koncept.ru/2016/56854.htm>
- Praliev, S., Zhampeisova, K., Khan, N., Kolumbaeva, Sh., & Kaydarova, A. (2015). Концептуальные основы системной модернизации педагогического образования в Республике Казахстан [Conceptual foundations of the system modernization of pedagogical education of the Republic Kazakhstan]. *Педагогика и психология: научно-методический журнал КазНПУ им. Абая*, 1(22), 44-60. Retrieved from [https://kaznpu.kz/docs/ins\\_pedagogiki\\_psih/Sistemnaya\\_modernizatsiya1.pdf](https://kaznpu.kz/docs/ins_pedagogiki_psih/Sistemnaya_modernizatsiya1.pdf)
- Sánchez-García, A. B., Marcos, J. J. M., GuanLin, H., & Escibano, J. P. (2013). Teacher development and ICT: The effectiveness of a training program for in-service school teachers. *Procedia-Social and Behavioral Sciences*, 92, 529-534. <https://doi.org/10.1016/j.sbspro.2013.08.713>
- Seryakova, S. B. (2016). Технологический подход в проектировании образовательных программ [Technological approach to designing of educational programs]. *Преподаватель XXI век*, 1(2), 24-32. Retrieved from <https://cyberleninka.ru/article/n/tehnologicheskij-podhodv-proektirovanii-obrazovatelnyh-programm>
- Slastenin, V. A. (2005). Профессионализм учителя как явление педагогической культуры [Teacher's professionalism as

- a phenomenon of pedagogical culture]. *Педагогическое образование и наука*, (3), 14-28. Retrieved from <https://cyberleninka.ru/article/n/professionalizm-uchitelya-kak-yavlenie-pedagogicheskoy-kultury-1>
- Thrupp, M. (2006). *Professional standards for teachers and teacher education: Avoiding the pitfalls*. Wellington: Post Primary Association and New Zealand Educational Institute.
- Uspanov, K., Zhansugirova, K., & Bissenbayeva, Z. (2013). Professionally important qualities inherent in a teacher – A measure of rationality regarding pedagogical processes. *Procedia – Social and Behavioral Sciences*, 89, 751-755. <https://doi.org/10.1016/j.sbspro.2013.08.927>
- Walder, A. M. (2014). The concept of pedagogical innovation in higher education. *Education Journal*, 3(3), 195-202. <https://doi.org/10.11648/j.edu.20140303.22>
- Zarudnaya, M., Fominykh, N., Enygin, D., Kudysheva, A., Epifanov, D., & Eferova, A. (2018). Methodological approaches to university instructors professional foreign languages competence development. *The Journal of Social Sciences Research*, 5, 375-381. <https://doi.org/10.32861/jssr.spi5.375.381>



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# The Development of the STEM (Science, Technology, Engineering, and Mathematics) Attitude and Motivation Survey Towards Secondary School Students

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**Abstract:** The purpose of the research was to determine the secondary school students' attitude and motivation toward STEM. For this purpose, two field studies for developing a survey were conducted. The first field study, pilot study, was performed for collecting the research data and making statistical analysis of the research data. After completing statistical analysis procedures (Explanatory Factor Analysis and Confirmatory Factor Analysis) of the pilot survey, the reliability and validity of the pilot survey was calculated. The statistical results indicated that the pilot survey was reliable and it also had four sub-factors. The second field study, main study, was performed for comparing and discussing the research data. The research was applied to 2912 students at different 14 secondary schools during the academic year of 2018-2019 at Izmir, Turkey. The students' results in the metropolitan and suburban regions of the city were compared. The results indicated the decrease in the attitude and motivation of students at higher levels in both regions toward STEM. When the results of the research were evaluated in terms of the sub-factors, the science and engineering values of secondary school students in the suburban were higher than the values of the students in metropolitan. It was not found a significant difference between the students' technology and mathematics values for both metropolitan and suburban. There was a significant difference between the 7<sup>th</sup> grade students' science, technology, engineering, and mathematics values instructed in metropolitan and suburban in favor of the students instructed in suburban. It was calculated that there was not a significant difference between the 6<sup>th</sup> and 8<sup>th</sup> grade students' all values for both the regions. It was only calculated that there was a significant difference between the 5<sup>th</sup> grade students' mathematics value. Investigations on gender factors showed that the female students' science, technology, engineering, and mathematics values were generally lower than the male students' values for both the regions.

*Keywords:* attitude, integrated STEM education, motivation, secondary school.

## Introduction

All countries need a broader and more coordinated teaching strategy in science, technology, engineering, and mathematics (STEM) at all levels from primary to university education. The teaching strategy in all the STEM disciplines should be to "address the need for greater diversity in the STEM professionals for a workforce with deep technical and personal skills, and for a STEM-literate citizenry prepared to address the grand challenges of the 21st century" (Bybee, 2010a, p.996). Sanders (2009, p.21) defined STEM education as "approaches that explore teaching and learning between/among any two or more of the STEM subject areas, and/or between a STEM subject and one or more other school subjects". Kelley and Knowles (2016, p.3) determined "integrated STEM education as the approach to teaching the STEM content of two or more STEM domains, bound by STEM practices within an authentic context for the purpose of connecting these subjects to enhance student learning." Brown et al. (2011, p.6) defined STEM education as "a standards-based, meta-discipline residing at the school level where all teachers, especially science, technology, engineering, and mathematics (STEM) teachers, teach an integrated approach to teaching and learning, where discipline-specific content is not divided, but addressed and treated as one dynamic, fluid study". At this point it is essential to focus on integrating different disciplines in modern education settings. Breiner et al. (2012) reported that it is difficult to concentrate with different disciplines in contemporary curriculum programs, these disciplines are not independent majors therefore

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each discipline is able to be thought of as a cluster. Educators and researchers can focus on combining four disciplines and bridging the relationships among four disciplines in today's technological world (Sanders, 2009; So et al., 2018).

The main purpose of STEM education is to foster qualified and skilled manpower (Luo et al., 2019). Also the purposes of STEM education are to develop industry and technology, to raise welfare levels, to increase literacy rates, etc. (Christensen, Knezek and Tyler-Wood, 2015; Hanson and Krywult-Albanska, 2020; Unfried et al., 2015).

Bybee (2011, p.6) determined that integrated STEM education focuses on eight factors which are "asking questions and defining problems, developing and using models, planning and carrying out investigations, analyzing and interpreting data, using mathematics and computational thinking, constructing explanations, designing solutions, engaging in argument from evidence, obtaining, evaluating, and communicating information". Students may begin to learn by becoming aware of the eight fundamental factors. Students may understand how to improve the design, inquiry, and analysis process and how to combine innovation and technology in a true STEM education environment. Students are able to study on projects and laboratory investigations with the STEM curriculum in cooperative learning groups. Besides, teachers may explain to students what they are to do and how they are taught in these education settings in order to develop deeper and richer understandings and abilities (Hasanah, 2020; Li et al., 2020; Margot and Kettler, 2019).

STEM helps students improve 21<sup>st</sup> century skills covered flexibility, adaptability, creativity, information resources management, media and technology literacy, self-management, social skills etc. and specifically ensures that students are sensitive citizens about energy efficiency, air and environmental pollution, climate change, use of natural sources, national security, personal healthy, economics, politics, and cultural values, personal, social and global issues, etc. STEM also makes significant contributions to the importance of science, the emphasis of technology, and the recognition of engineering in all school programs (Bybee, 2010b; Sanders, 2009).

STEM will play an important role in students' career choices nowadays and in the near future. Many students will generally focus on STEM-based jobs instead of natural sciences, medical fields, engineering jobs. Employers in industries will also consider qualified workers with STEM-related skills for filling empty and critical positions (Abe and Chikoko, 2020; Brown et al., 2011). Therefore determining and guiding students' academic choices are quite important at the primary and/or secondary school levels in today's world. The academic choices of students have lately been begun to investigate in depth by researchers (Craig et al., 2018; Maltese and Tai, 2011; Sadler et al., 2012; Unfried et al., 2015).

Integrated STEM education plays an important role in improving students' problem solving skills, creative thinking, social skills, communication and collaboration skills, self-management skills, critical thinking, and analytical thinking (Brown et al., 2011). When integrated STEM education based on constructivist (Bransford, Brown and Cocking, 2000; Sanders, 2009) will be applied at schools or universities, it will pave the way for some radical changes according to the present education systems such as teaching methods (inquiry-based learning, project-based learning, problem-based learning, design-based learning, etc.) and assessment of materials, teacher training, class environment, etc. However, these kinds of radical changes are also responsible for taken responsibility time, effort, support and financial commitment (Leung, 2020; Merrill, 2001; Sanders, 2009). Integrated STEM education contributes rediscovering present scientific knowledge based on learning science and mathematics, developing engineering and technological design processes, thinking about real world issues, enhancing analytical thinking, seeking solutions toward social, economic, and environmental issues, and contributing to the establishment of interdisciplinary relations of students at all grade levels.

The most important feature that distinguishes this study from other studies is the determination of secondary school students' tendencies towards science, technology, engineering and mathematics. After the STEM trends of the secondary school students are determined, program development experts will need to create a curriculum according to the determined trends. Teachers will need to determine alternative teaching strategies in order to achieve the goals determined according to the curriculum prepared. School administrations will need to provide the necessary equipment and materials to enable teachers and students to carry out activities based on research, project, collaboration, etc. The study is mainly focused on the tendency of the secondary school students. The other results of the research are focused on attracting the attention of school administrators, curriculum development experts and teachers.

## STEM Education in Turkey

In Turkey, science and mathematics classes are taught to the students at the secondary school level by using traditional educational approaches rather than integrated STEM education which are expressed together with science, technology, engineering and mathematics (Cevik, 2017; Yamak, Bulut and Dunder, 2014). In this approach many science teachers just teach the students the area course without thinking about different disciplines, and they usually do not mention science applications toward engineering and technology at their own classes. The students have science, mathematics, computers, etc. classes but these classes are separately taught to the students by using traditional education which is focused on one discipline (e.g., science, mathematics). Therefore they may not synthesize instructed subjects, they might easily forget independent of taught knowledge, they may not be interested in STEM subjects, and they might not choose a STEM career, they can graduate from secondary and/or high schools with lower science and/or mathematics. Besides, the students are not taught engineering and technology classes in their own school curriculum and the national educational programs.

The primary goal of the present study is defining the attitude and motivation of the secondary school students by thinking Turkish students' demographic characteristics with a developed STEM attitude and motivation survey with the support of the Ministry of National Education. It is expected that this developed STEM survey in the research will fill the gap in the literature for thinking countries like us.

## Materials and Methods

The present research covered two sections. The first section examined the pilot survey development procedures. The section consisted of conducting literature review, creating a large pool of the pilot survey items, taking expert opinions for items of the pilot survey, and performing factor analysis based on "exploratory factor analysis" and "confirmatory factor analysis". The second section contained the application of the survey developed for attitude and motivation toward STEM. This section discussed the findings of the developed survey.

### The Pilot Survey Development Procedures

The literature on STEM surveys (Faber et al., 2013; Kier et al., 2014; Tyler-Wood, Knezek and Christensen, 2010) measured the attitude and motivation of the students toward STEM disciplines was reviewed by using of ERIC, Google Scholar, and Science Direct. Volunteer 30 students were asked to write their own views on the integrated STEM education item by item. The similar expressions were considered based on students' perspectives. Examined surveys and written views helped to determine items of the pilot survey and made a significant contribution of the pilot survey with 69 items. The pilot survey was sent to the five STEM specialists and six science, mathematics, and computer teachers working in STEM education for assessing the content validity. According to the expert recommendations, the pilot survey with 69 items on the five-point Likert scale was reviewed for each item. The items were scaled from strongly agree "5" to strongly disagree "1".

### Participants

The data of the pilot survey were collected from 1335 students in seven public secondary schools during the academic year of 2018-2019 in the third largest city (Izmir) of Turkey. The schools had not ever implemented integrated STEM education program. The pilot study was performed in two regions of Izmir in order to generalize the obtained findings of the research. The first region was metropolitan. The region covering two districts were randomly chosen by thinking of time and budget of the research. The second region was suburban. The region was close to the city center and was the author's workplace. All of the students were voluntary in the research. The students were anonymously asked to fill the survey and the surveys were coded randomly.

The pilot survey of 192 students who filled the survey incorrectly and/or incompletely were not evaluated. Therefore the statistical analysis of the pilot survey was conducted on 1143 students. Six hundred and thirty-four of 1143 students were female and the rest of them were male. Table 1 indicates the demographic variables of the students. The 5<sup>th</sup> grade students were not taken part in the research. Because they went through the adaptation period for transition from primary to secondary school.

**Table 1**  
*Demographic variables of the students*

	Female	%	Male	%	Total	%
6 <sup>th</sup> grade	202	57.7	148	42.3	350	30.6
7 <sup>th</sup> grade	234	55.1	191	44.9	425	37.2
8 <sup>th</sup> grade	198	53.8	170	46.2	368	32.2

Students were approximately given ten minutes to fill out the pilot survey in their own class time. Before handing out the pilot survey, the explanatory information about the pilot survey were briefly presented to the students.

### Data Analysis

The statistical analysis of the pilot survey was examined in two subtitles which are Explanatory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). EFA was performed by SPSS Statistics 25 while CFA was conducted on AMOS 25 Graphics program.

### Explanatory Factor Analysis (EFA) of the Pilot Survey

The pilot survey according to EFA consisted of 34 items. All items in the pilot survey were positive statements. Some statistical analysis data concerning the pilot survey were given as follows: Bartlett's test of sphericity was measured as 20429.593,  $df=561$ ,  $p<.001$ , KMO (Kaiser-Meyer-Olkin) value was calculated as .91, total explained variance value was measured as 57.94% and Cronbach's Alpha value was calculated as .84. The obtained statistical data showed that the factor analysis for the pilot survey was appropriate (Hair et al., 2014). The pilot survey found four sub-factors. The sub-factors were named considering the content of the research. The first factor consisted of 7 items and was called "Science" (S). The second factor comprised 8 items and was called "Technology" (T). The third factor consisted of 10 items and was called "Engineering" (E). The last factor comprised 9 items and was called "Mathematics" (M). Figure 1 indicates the relationship between the items and eigenvalues of the pilot survey. The factor loadings of the items (see in Appendix 1) are over .65 and the eigenvalues of sub-factors were above "1". When the examined studies (Hair et al., 2014; Tabachnick and Fidell, 2012) in the literature were evaluated, it could be said that the values obtained from explanatory factor analysis are "high" and "acceptable".

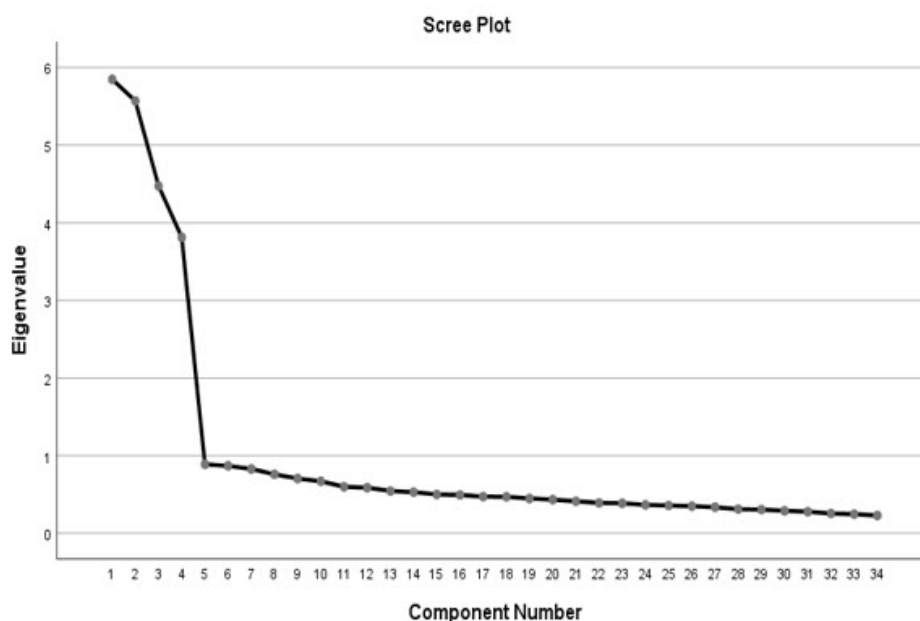


Figure 1. The relationship between the items and eigenvalues of the pilot survey

## Confirmatory Factor Analysis (CFA) of the Pilot Survey

CFA was conducted to support EFA results of the pilot survey. CFA values are expected results between “acceptable fit” and “good fit”. After the statistical analyses were performed, the modification index values were observed between “acceptable fit” and “good fit”. Table 2 illustrates the CFA measurement values.

**Table 2**  
*The fit indexes of CFA*

Fit Indexes	Measurement	Reference Value*	
		Acceptable/Reasonable Fit	Good Fit
CMIN/df	2.63	$x^2/df \leq 5$	$x^2/df \leq 3$
NFI	.93	$.90 \leq NFI$	$.95 \leq NFI$
TLI(NNFI)	.95	$.90 \leq NNFI$	$.95 \leq NNFI$
IFI	.95	$.90 \leq IFI$	$.95 \leq IFI$
CFI	.95	$.95 \leq CFI$	$.97 \leq CFI$
RMSEA	.03	$RMSEA \leq .08$	$RMSEA \leq .05$
GFI	.93	$.85 \leq GFI$	$.90 \leq GFI$
AGFI	.92	$.85 \leq AGFI$	$.90 \leq AGFI$
RMR	.04	$0 < RMR \leq .08$	$0 < RMR \leq .05$
SRMR	.02	$0 < SRMR \leq .08$	$0 < SRMR \leq .05$

Note: CMIN/df, Chi-Square Goodness of Fit for AMOS; NFI, Normed Fit Index; NNFI, Non-Normed Fit Index or TLI, Tucker-Lewis Index; IFI, Incremental Fit Index; CFI, Comparative of Fit Index; RMSEA, Root Mean Square Error Approximation; GFI, Goodness of Fit Index; AGFI, Adjusted Goodness of Fit Index; RMR, Root Mean Square Residual; SRMR, Standardized Root Mean Square Residual; \* Reference Value: (Karagoz, 2016; Schermelleh-Engel, Moosbrugger, and Müller, 2003)

The results obtained from CFA according to examined studies in the literature (Byrne, 2013; Hu and Bentler, 1999; Karagoz, 2016; Schermelleh-Engel, Moosbrugger and Müller, 2003) indicated that the calculated measurement values are “valid”, and “reliable”. Figure 2 shows the factor loading values of the pilot survey according to CFA.

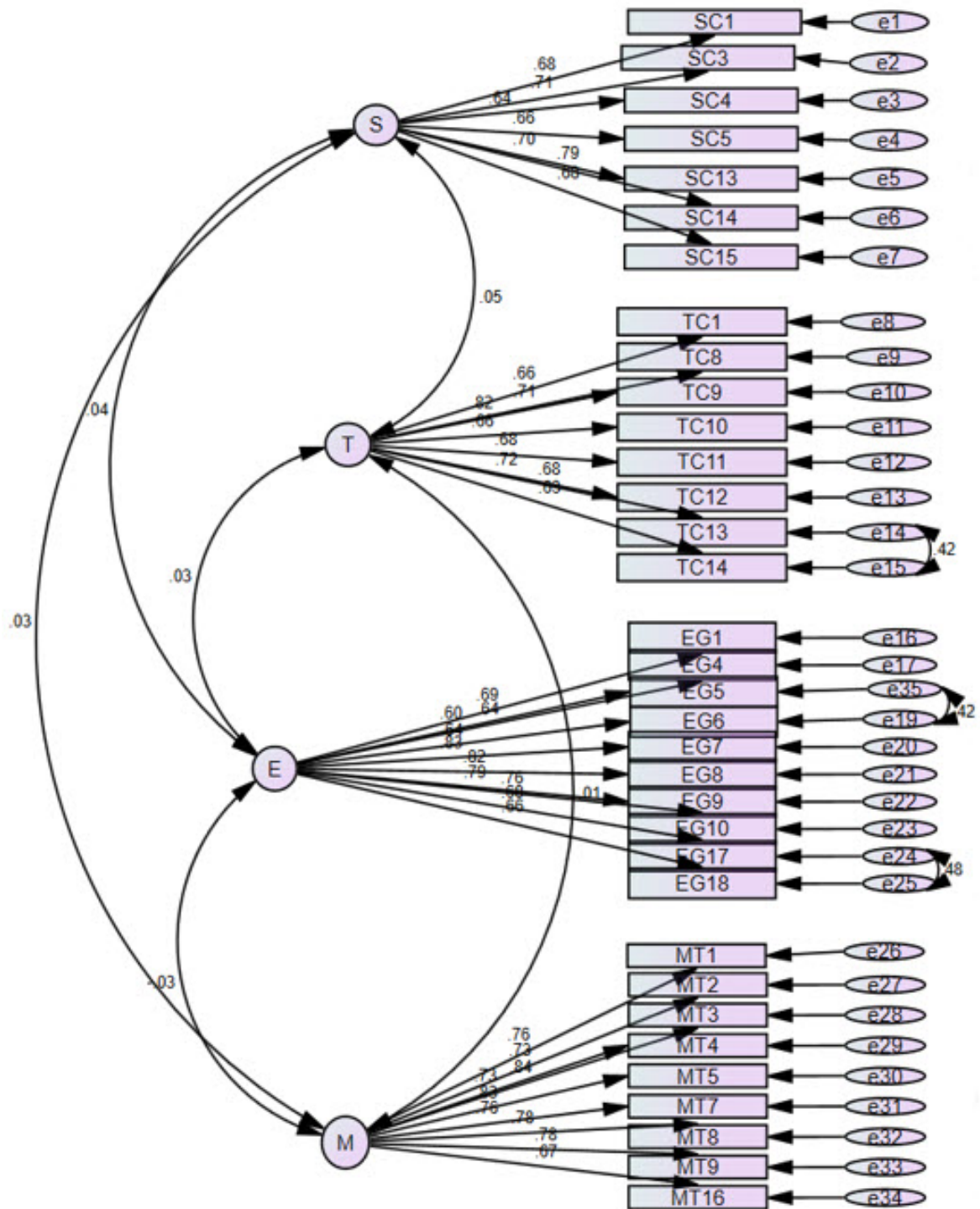


Figure 2. The factor loading values of the pilot survey according to CFA

## Results

### The Application of the Developed Survey

A new field study was conducted to evaluate the results of the developed survey. The second field study was performed by different students except the schools visited for the pilot survey. In this study, the following research questions were investigated: 1) Is there a significant difference between the grade levels of the students toward the STEM attitude and motivation surveys? 2) Is there a significant difference between the female students instructed in metropolitan and suburban toward STEM attitude

and motivation surveys? 3) Is there a significant difference between the male students instructed in metropolitan and suburban toward STEM attitude and motivation surveys?

The data of the developed survey were collected from 1577 students in seven different secondary schools during the academic year of 2018-2019 in the third largest city (İzmir) of Turkey. Three hundred and forty-seven of 1577 student surveys were not evaluated because of missing data. One thousand two hundred and thirty students filled out the survey in full. Six hundred and eighty-three students live in the metropolitan and the others live in the suburbs. Six hundred and fourteen of 1230 students were female and the other students were male. Table 3 indicates the demographic characteristics distributions according to region, gender and grade level of the students. In this process for the developed survey, 5<sup>th</sup> grade students' data were used to compare and discuss the results of the students at all grade levels.

**Table 3**  
*The demographic characteristics of the students*

	Female				Male				Total	
	M	%	S	%	M	%	S	%	M-S	%
5 <sup>th</sup> grade	101	30.06	56	20.14	93	26.80	49	18.22	299	24.31
6 <sup>th</sup> grade	82	24.40	76	27.34	85	24.50	67	24.90	310	25.20
7 <sup>th</sup> grade	72	21.43	81	29.14	75	31.61	72	26.77	300	24.39
8 <sup>th</sup> grade	81	24.11	65	23.38	94	27.09	81	30.11	321	26.10

Note: M: Metropolitan; S: Suburban

Table 4 demonstrates the independent samples t-test results according to the students' grade levels. It was realized that there was not a significant difference between the 5<sup>th</sup> grade students' science, technology, engineering and total STEM values except their own mathematics value. Also there was not a significant difference between the 6<sup>th</sup> grade students' and between the 8<sup>th</sup> grade students' science, technology, engineering, mathematics and total STEM values. It was found that there was a significant difference between the 7<sup>th</sup> grade students' all values.

**Table 4**  
*The comparative results of the survey according to the grade levels*

	S	T	E	M	STEM
5 <sup>th</sup> grade	$t_{(297)} = .88 p > .05$	$t_{(297)} = .22 p > .05$	$t_{(297)} = .54 p > .05$	$t_{(297)} = 2.50 p < .05$	$t_{(297)} = 1.51 p > .05$
6 <sup>th</sup> grade	$t_{(308)} = 1.91 p > .05$	$t_{(308)} = .27 p > .05$	$t_{(308)} = .19 p > .05$	$t_{(308)} = 1.44 p > .05$	$t_{(308)} = .07 p > .05$
7 <sup>th</sup> grade	$t_{(298)} = 4.61 p < .05$	$t_{(298)} = 3.22 p < .05$	$t_{(298)} = 3.41 p < .05$	$t_{(298)} = 5.37 p < .05$	$t_{(298)} = 5.67 p < .05$
8 <sup>th</sup> grade	$t_{(319)} = 1.83 p > .05$	$t_{(319)} = 1.66 p > .05$	$t_{(319)} = 1.57 p > .05$	$t_{(319)} = .01 p > .05$	$t_{(319)} = 1.58 p > .05$

Table 5 presents the descriptive statistics of students' attitude and motivation towards STEM in metropolitan and suburban areas. Table 6 and Table 7 also show the mean of students' attitude and motivation toward STEM according to the grade level, gender and region. The answers of the students studied in metropolitan were in the range of 34 and 170 points while the answers of the students studied in sub-urban were in the range of 45 and 170 points.

**Table 5**  
*The mean of the students' surveys according to gender and region*

	R	Female			Male			Total		
		N	AM	SD	N	AM	SD	N	AM	SD
S	M	336	25.66	6.55	347	24.54	6.68	683	25.09	6.63
	S	278	26.47	5.62	269	26.01	6.15	547	26.25	5.89
T	M	336	27.68	7.43	347	30.71	6.67	683	29.22	7.21
	S	278	28.42	6.58	269	31.39	6.77	547	29.88	6.83
E	M	336	30.43	10.53	347	35.58	10.26	683	33.04	10.70
	S	278	31.47	9.57	269	37.23	9.56	547	34.30	9.98
M	M	336	32.92	9.81	347	30.95	10.10	683	31.92	9.99
	S	278	33.27	9.85	269	30.90	10.13	547	32.10	10.05
STEM	M	336	116.69	26.70	347	121.78	24.58	683	119.28	25.75
	S	278	119.63	23.03	269	125.52	23.63	547	122.53	23.50

Note: R: Region; AM: Arithmetic Mean; SD: standard deviation

The results of the students instructed in metropolitan and suburban were compared with independent samples t-test. The statistical analysis according to the sub-factors of the developed survey were calculated as  $t_{(1228)}=3.18 p<.05$  for "Science",  $t_{(1228)}=1.63 p>.05$  for "Technology",  $t_{(1228)}=2.11 p<.05$  for "Engineering",  $t_{(1228)}=.31 p>.05$  for "Mathematics", and finally  $t_{(1228)}=2.28 p<.05$  for "STEM" respectively. The results of the female and male students instructed in metropolitan and suburban were compared with independent samples t-test. The statistical analysis results of the female students according to the sub-factors of the developed survey were calculated as  $t_{(612)}=1.61 p>.05$  for "Science",  $t_{(612)}=1.29 p>.05$  for "Technology",  $t_{(612)}=1.27 p>.05$  for "Engineering",  $t_{(612)}=.43 p>.05$  for "Mathematics", and finally  $t_{(612)}=1.44 p>.05$  for "STEM" respectively. The statistical analysis results of the male students according to the sub-factors of the developed survey were calculated as  $t_{(614)}=2.81 p<.05$  for "Science",  $t_{(614)}=1.23 p>.05$  for "Technology",  $t_{(614)}=2.03 p<.05$  for "Engineering",  $t_{(614)}=.06 p>.05$  for "Mathematics", and finally  $t_{(614)}=1.90 p>.05$  for "STEM" respectively.

After the descriptive statistics as shown in Table 6 and Table 7 were determined, the comparative analysis was calculated according to the grade levels and gender of the students in metropolitan and suburban areas. It was calculated that there was not a significant difference between the male students' science, technology, engineering, mathematics and total STEM values and between the female students' science, technology and total STEM values for 5<sup>th</sup>-8<sup>th</sup> grade levels.

**Table 6**  
*The means of the students' survey according to the grade level and gender in metropolitan*

	5 <sup>th</sup> grade			6 <sup>th</sup> grade			7 <sup>th</sup> grade			8 <sup>th</sup> grade		
	F	M	AM	F	M	AM	F	M	AM	F	M	AM
S	28.59	27.17	27.91	25.90	23.02	24.44	23.85	22.76	23.29	23.37	24.72	24.10
T	30.92	32.54	31.70	28.33	31.07	29.72	25.38	28.71	27.07	25.04	30.19	27.81
E	33.52	36.15	34.78	32.09	34.67	33.40	27.47	34.81	31.22	27.52	36.44	32.31
M	37.01	35.73	36.40	35.39	30.41	32.86	28.68	26.95	27.80	29.09	29.90	29.53
STEM	130.05	131.59	130.79	121.71	119.18	120.42	105.38	113.23	109.04	105.01	121.26	113.74

**Table 7**  
*The means of the students' survey according to the grade level and gender in suburban*

	5 <sup>th</sup> grade			6 <sup>th</sup> grade			7 <sup>th</sup> grade			8 <sup>th</sup> grade		
	F	M	AM	F	M	AM	F	M	AM	F	M	AM
S	27.46	27.16	27.32	25.55	26.00	27.76	26.57	26.92	26.73	26.55	24.53	25.43
T	30.63	32.55	31.52	27.54	31.76	29.52	28.22	31.42	29.73	27.82	30.35	29.22
E	31.86	36.59	34.07	30.17	37.54	33.62	32.06	38.75	35.21	31.92	36.00	34.18
M	36.68	30.35	33.72	31.36	31.31	31.34	33.91	34.46	34.17	31.75	27.72	29.51
STEM	126.63	126.65	126.64	114.62	126.61	120.24	120.77	131.54	125.84	118.05	118.59	118.35

Note: F: Female; M: Male; AM: Arithmetic Mean

## Discussions

In this section, the results obtained from the statistical analysis were generally discussed. Figure 3 presents that the attitude and motivation of the students instructed in metropolitan and suburban towards STEM broadly decreased from 5<sup>th</sup> grade level to 8<sup>th</sup> grade level. The attitude and motivation of the students studying in the metropolitan area diminished by 9 percent while the attitude and motivation of the students studying in the suburbs decreased by 6 percent.

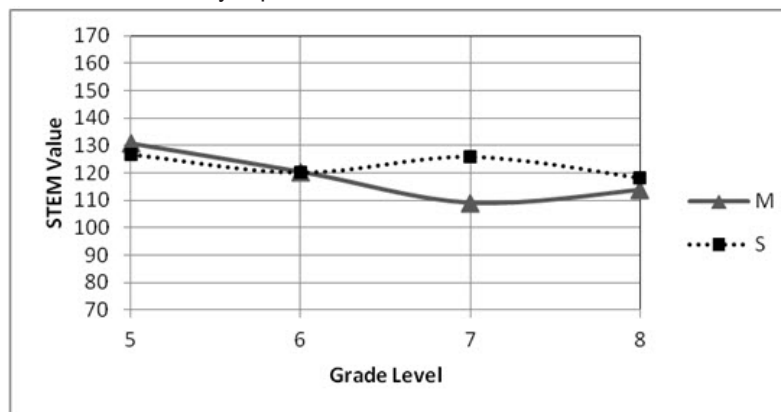


Figure 3. The students' STEM mean value according to the grade level and region

According to the first research question, there was not a meaningful difference between the students' values instructed in the 5<sup>th</sup> grade level, the 6<sup>th</sup> grade level and 8<sup>th</sup> grade level except the 7<sup>th</sup> grade level toward STEM attitude and motivation survey.

The 5<sup>th</sup> grade and the 6<sup>th</sup> grade students in metropolitan and suburban might have spent more time for the orientation period from primary school to the secondary school. The students in the 8<sup>th</sup> grade level were prepared for high school exams in order to enroll in state, private, science, and vocational high schools. These students might not have adequately shown the interest in STEM disciplines because of exam stress and anxiety. The students in the 7<sup>th</sup> grade level might have been more interested in STEM disciplines because they quickly completed the orientation period and they did not have any high school exam stress and anxiety. The 7<sup>th</sup> grade students in the suburbs were more curious and enthusiastic toward STEM disciplines than the students in the metropolitan. They followed the developments and innovations in science, technology and engineering fields. Shortly, the students in suburban areas focused on less cultural activities, more on STEM disciplines.

The decreases in the graph show that the STEM viewpoints of the students in metropolitan and suburban negatively influenced while going from the 5<sup>th</sup> grade level to the 8<sup>th</sup> grade level. The decline on the attitude and motivation of the students toward STEM could be explained in terms of the students, the teachers and the schools as follows: a) Many students may not be interested in STEM, they may not want to study science and mathematics classes, they may have been guided to different disciplines (e.g., political sciences, visual art, social science, sports science etc.) in their career choice except STEM disciplines. b) The teachers may not have received any education on STEM, so the students may not have been adequately informed and guided about STEM, they may have used traditional educational methods and approaches instead of integrated STEM education based on project-based learning, problem-based learning, inquiry-based learning, cooperative learning etc. Science teachers generally performed in their own lessons in the classroom environment instead of the laboratory environment. Therefore many students may have decreased interest and curiosity towards STEM. c) The necessary and sufficient physical conditions (e.g., budget, laboratory tools, class, computers, internet, etc.) of the schools may not be convenient for integrated STEM education in terms of the secondary schools.

Figure 4a and Figure 4b indicate the total STEM value of the female and male students instructed in metropolitan and suburban.

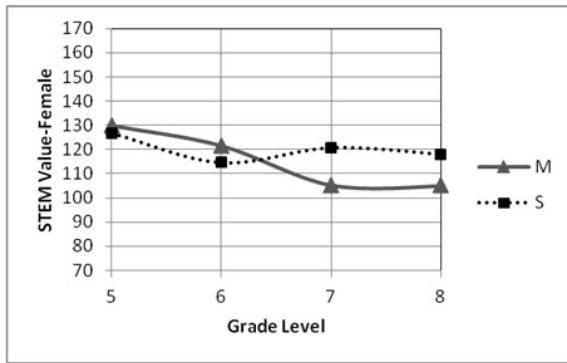


Figure 4a. Female students' STEM mean value according to the grade level and region

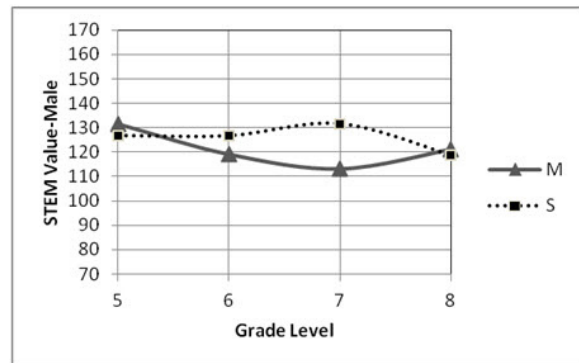


Figure 4b. Male students' STEM mean value according to the grade level and region

The STEM value of the female students instructed in metropolitan and suburban decreased from the 5<sup>th</sup> grade level to the 8<sup>th</sup> grade level. The decline values were calculated as 16 percent for metropolitan and 6 percent for suburban. According to the second research question, there was not a meaningful difference between the female students' values instructed in metropolitan and suburban toward STEM attitude and motivation surveys. But, total STEM values of the female students in the metropolitan generally decreased from the 5<sup>th</sup> grade level to the 8<sup>th</sup> grade level. Total STEM values of the female students in suburban areas varied from the 5<sup>th</sup> grade level to the 8<sup>th</sup> grade level. The STEM attitude and motivation values of the female students decreased at the 6<sup>th</sup> grade level. The values of the female students increased at the 7<sup>th</sup> grade level and negatively showed small change in the 8<sup>th</sup> grade level. The female students in suburban areas were more interested in science, technology, engineering, and mathematics disciplines according to the female students instructed in metropolitan areas.

The STEM value of the male students instructed in metropolitan and suburban also decreased from the 5<sup>th</sup> grade level to the 8<sup>th</sup> grade level. The decline values were found as 7 percent for metropolitan and 5 percent for suburban respectively. According to the third research question, there was not a meaningful difference between the male students instructed in metropolitan and suburban toward STEM attitude and motivation surveys. But, total STEM values of the male students in metropolitan generally decreased from the 5<sup>th</sup> grade level to the 8<sup>th</sup> grade level. Total STEM values of male students instructed in metropolitan schools began to rise from the 7<sup>th</sup> grade level to the 8<sup>th</sup> grade level. Total STEM values of the male students increased from the 5<sup>th</sup> grade level to the 7<sup>th</sup> grade level and then the values of the male students decreased at the 8<sup>th</sup> grade level. It could be said that the male students as in the female students in suburban might have been more willing and interested in science, technology, engineering, and mathematics disciplines according to the male students instructed in metropolitan.

Broadly, the total STEM values of the male and female students instructed in metropolitan were lower than the total STEM values of the male and female students instructed in suburban. The attitude and motivation values toward STEM of the female students in metropolitan according to grade levels were lower than the STEM values of the male students. The STEM value of female students instructed in metropolitan areas declined from 131 points to 105 points. It could be said that as the grade levels of the students in suburban and metropolitan increases, the students' attitude and motivation values toward STEM decreases. These decline values might be attributed to following points: The female and male students in metropolitan may not be interested in STEM, they might have gotten around to cultural activities more time instead of learning science and mathematics classes, they might have difficulties in learning science and mathematics.

Figure 5a and Figure 6a indicate the science mean values of the female and male students in metropolitan and suburban areas. Science values of the male students in metropolitan and suburban changed at the same rate (6%). Science values of the female students in suburban areas did not considerably change. But, the science value of the female students in metropolitan areas considerably decreased from the 5<sup>th</sup> grade level to the 8<sup>th</sup> grade level. The decrease was approximately 17 percent. These results indicated that many of the female students may have problems visualizing abstract concepts and understanding fundamental concepts and principles about science. The science values of the female students may also have been affected from the following factors: a) the cultural level of the society may be an important factor in the choice of profession of the female students. b) the female students might worry about the future, c) psychological and sociological support may not be provided to the female students during their career choices, d) the female students may see themselves insufficient for science

and mathematics classes, e) the female students might not show any interest in science and mathematics classes.

Figure 5b and Figure 6b present the technology mean values of the female and male students in metropolitan and suburban. The technology value of the female students dramatically decreased from the 5<sup>th</sup> grade level to the 8<sup>th</sup> grade level. This decline was roughly 15 percent. The technology values of the other students in metropolitan and suburban areas negatively changed at the same rate. The rate of change was about 8 percent. Concern with technology of the female students instructed in metropolitan was lower than other students. As understood from the graphics, the female students were not interested in technology, the female students may have directed their interests and curiosity to different disciplines. Besides, the students may not generally have technology design class and computer class in their schools, they might not have enough computers and internet in their school, they may not have technology and design teachers in their schools.

Figure 5c and Figure 6c illustrate the engineering mean values of the female and male students in metropolitan and suburban. The engineering values of the male students in metropolitan and the female students in suburban did not change. The engineering value of the male students in suburban schools slightly changed from the 5<sup>th</sup> grade level to the 8<sup>th</sup> grade level with a 2 percent decline. The engineering value of the female student declined from the 5<sup>th</sup> grade level to the 8<sup>th</sup> grade level by 12 percent. The engineering values presented show that many students except the female students in metropolitan areas may take interest in engineering. Many students want to pursue their own careers on in engineering education. Most students may enjoy repairing electronic and mechanical devices. They like to see engineering applications in their daily lives. Many students also prefer the engineering profession to lead a more comfortable life and earn a lot of money.

Figure 5d and Figure 6d present the mathematics mean values of the female and male students in metropolitan and suburban. The mathematics values of all students decreased. The decline of mathematics values of the female (18%) and male (13%) students trained in metropolitan was higher than the decrease of mathematics values of the female (11%) and male (5%) students trained in suburban. The findings indicated that many students do not want to choose a career in this field. Many students might not like to learn mathematics, they might have difficulty performing and understanding mathematical operations, teachers may not have experience in subject knowledge and pedagogical knowledge on the students' attitudes.

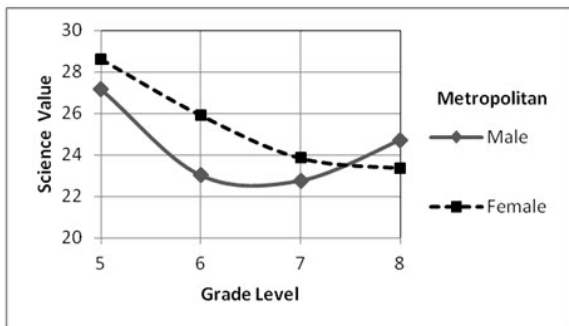


Figure 5a. The science mean value of the students

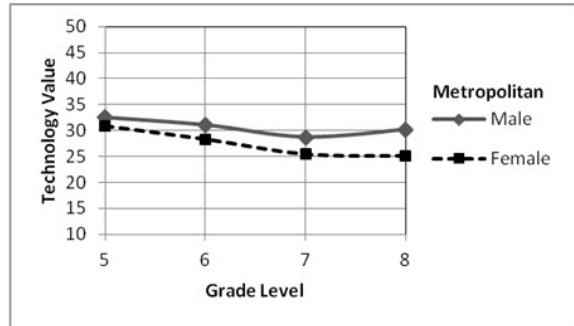


Figure 5b. The technology mean value of the students

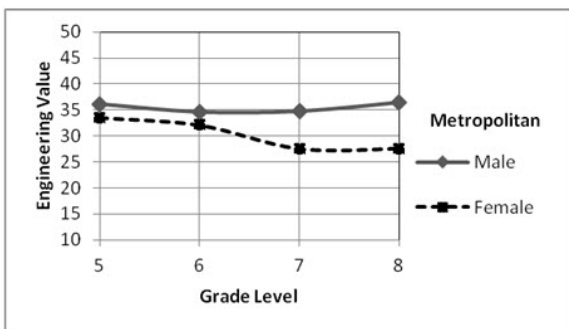


Figure 5c. The engineering mean value of the students

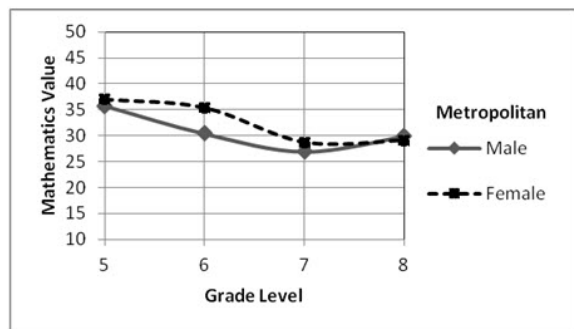


Figure 5d. The mathematics mean value of the students

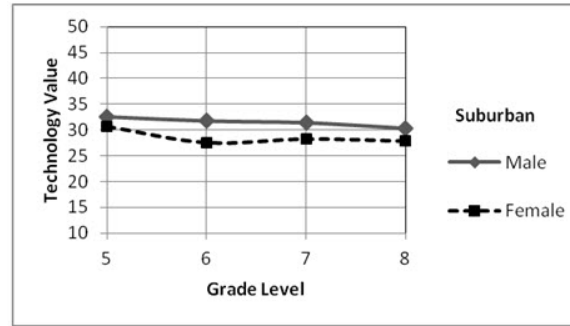
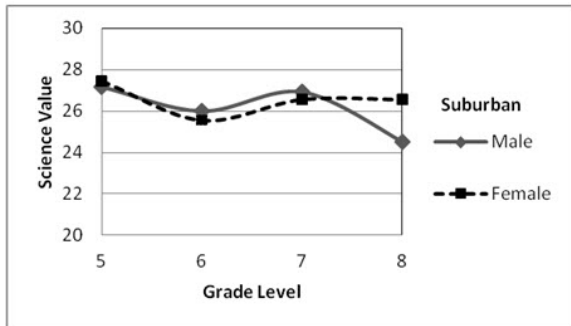


Figure 6a. The science mean value of the students Figure 6b. The technology mean value of the students

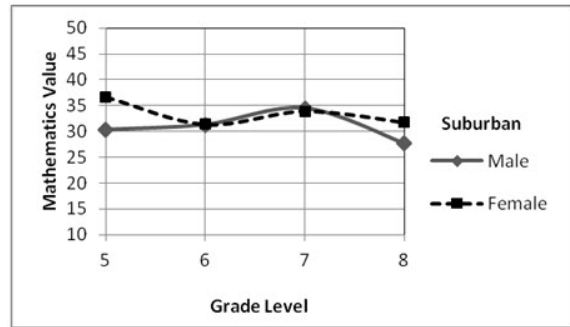
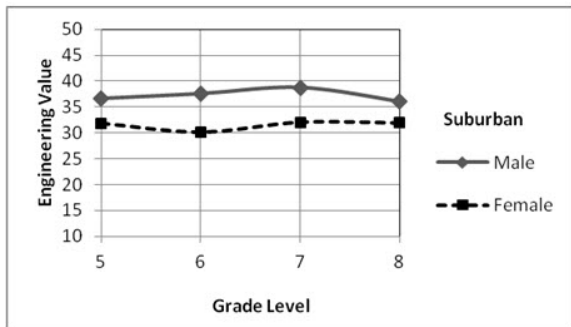


Figure 6c. The engineering mean value of the students

Figure 6d. The mathematics mean value of the students

## Conclusions

The difference of this study from other conducted studies that are adaptation of the STEM questionnaire or that focuses on the development and approval procedures of a new STEM questionnaire (Barlow et al., 2020; Faber et al., 2013; Guzey, Harwell and Moore, 2014; Paul, Maltese and Valdivia, 2020; Unfried et al., 2015), focusing on developing the “STEM attitude and motivation survey” in secondary school and discussing the collected data in terms of grade and region with the help of second field research. Statistical analysis results of the attitude and motivation survey toward STEM indicated that the reliability and validity of the developed survey was reliable and helpful to identify the students’ attitude and motivation for science, technology, engineering, and mathematics fields. The research was conducted to the secondary school students instructed in metropolitan and suburban. The results of the developed survey were presented that the total values of the students instructed in suburban were higher than the total values of the students instructed in metropolitan. The attitude and motivation of both the female students and the male students in suburban and metropolitan toward STEM decreased from the 5<sup>th</sup> grade level to 8<sup>th</sup> grade level. This decline in suburban students was relatively less according to metropolitan students. The science, technology, and engineering values of the female students in metropolitan were comparatively lower than the male students’ values. The similar studies (Blatt et al., 2020; Kurban and Cabrera, 2020; Whitcomb et al., 2020) in the STEM field support the results of the research. The mathematics values of the female and male students remained at the same level from the 5<sup>th</sup> grade level to the 8<sup>th</sup> grade level and the mathematics values of the students declined as in other sub-factors. The science and mathematics values of the female students instructed in suburban schools were slightly higher than the male students’ values. The technology and engineering values of the male students in the suburbs was higher than the female students’ values. Especially the attitude and motivation for engineering field of the male students were higher than the other fields.

## Recommendations

Some recommendations based on the results of the research could be listed as follows: Integrated STEM education might be applied at all grade levels in the course of time. A sustainable education policy should be followed to discuss the results of the integrated STEM education. Field teachers might be

given training about integrated STEM education. The importance of integrated STEM education may be explained to policy makers and administrators. The importance of integrated STEM education might be explained to the society. The importance of technology and engineering could be explained to the students. Field teachers may encourage students to do hands-on activities in a laboratory environment. Science, technology design and mathematics teachers in the schools might work in cooperation by using integrated teaching and learning approaches. School administrators may establish a strong interaction and communication between school and faculty of engineering and natural sciences for the development of the students. The teachers might integrate their own classes with technology and engineering, explain relationships between technology and engineering with the help of richer and deeper integrated STEM curriculum programs. Researchers could examine the effects of integrated STEM education on students' academic achievement with the help of the experimental studies. There are not enough studies about students' achievement in the literature. More studies and data in order to evaluate and interpret the effects of the integrated STEM education are needed in the literature.

### Limitations

The limitations of the research are given as follows: The pilot survey and the developed survey can be applied to many more secondary school students in different cities of Turkey. The pilot survey was not applied to the 5<sup>th</sup> grade students. Because they experienced the orientation process. The relationships between academic achievement in science and mathematics and attitude and motivation towards STEM surveys of the secondary school students can be examined. The effects of parents' education level on students' perspective on STEM fields should be investigated.

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### Conflict of interests

The author declares no conflict of interest.

### References

- Abe, E. N., & Chikoko, V. (2020). Exploring the factors that influence the career decision of STEM students at a university in South Africa. *International Journal of STEM Education*, 7, 60, 1-14. <https://doi.org/10.1186/s40594-020-00256-x>
- Barlow, A., Brown, S., Lutz, B., Pitterson, N., Hunsu, N., & Adesope, O. (2020). Development of the student course cognitive engagement instrument (SCCEI) for college engineering courses. *International Journal of STEM Education*, 7, 22, 1-20. <https://doi.org/10.1186/s40594-020-00220-9>
- Blatt, L., Schunn, C. D., Votruba-Drzal, E., & Rottman, B. M. (2020). Variation in which key motivational and academic resources relate to academic performance disparities across introductory college courses. *International Journal of STEM Education*, 7, 58, 1-25. <https://doi.org/10.1186/s40594-020-00253-0>
- Bransford, J. D., Brown, A. L., & Cocking, R. R. (2000). *How people learn: Brain, mind, experience, and school*. Washington, DC: National Academy Press. Retrieved from <http://www.csun.edu/~SB4310/How%20People%20Learn.pdf>
- Breiner, J. M., Harkness, S. S., Johnson, C. C., & Koehler, C. M. (2012). What is STEM? A discussion about conceptions of STEM in education and partnerships. *School Science and Mathematics*, 112(1), 3-11. <https://doi.org/10.1111/j.1949-8594.2011.00109.x>
- Brown, R., Brown, J., Reardon, K., & Merrill, C. (2011). Understanding STEM: current perceptions. *Technology and Engineering Teacher*, 70(6), 5-9. Retrieved from <http://www.stemteacherlearning.com/uploads/topics/stem-curricula/Understanding%20STEM.pdf>
- Bybee, R. W. (2010a). What is STEM education? *Science*, 329, 996. <https://doi.org/10.1126/science.1194998>
- Bybee, R. W. (2010b). Advancing STEM education: A 2020 vision. *Technology and engineering teacher*, 70(1), 30-35. Retrieved from <https://search.proquest.com/openview/75bbe8b13bf3f54ebd755333ffd8621e/1?pq-origsite=gscholar&cbl=34845>
- Bybee, R. W. (2011). Scientific and engineering practices in K-12 classrooms: Understanding a framework for K-12 science education. *Science and Children*, 49(4), 10-16. Retrieved from [https://www.nmu.edu/seaborg/sites/DrupalSeaborg/files/UserFiles/Files/NGSS/Scientific\\_and\\_Engineering\\_Practices\\_in\\_K-12\\_Classrooms\\_by\\_Rodger\\_Bybee.pdf](https://www.nmu.edu/seaborg/sites/DrupalSeaborg/files/UserFiles/Files/NGSS/Scientific_and_Engineering_Practices_in_K-12_Classrooms_by_Rodger_Bybee.pdf)
- Byrne, B. M. (2013). *Structural equation modeling with AMOS: Basic concepts, applications, and programming* (2<sup>nd</sup> ed.). New York: Routledge.
- Çevik, M. (2017). A study of STEM Awareness Scale development for high school teachers Ortaöğretim öğretmenlerine yönelik FeTeMM Farkındalık Ölçeği (FFÖ) geliştirme çalışması. *Journal of Human Sciences*, 14(3), 2436-2452. Retrieved from

- <https://www.j-humansciences.com/ojs/index.php/IJHS/article/view/4673>
- Christensen, R., Knezek, G., & Tyler-Wood, T. (2015). Alignment of hands-on STEM engagement activities with positive STEM dispositions in secondary school students. *Journal of Science Education and Technology*, 24(6), 898-909. <https://doi.org/10.1007/s10956-015-9572-6>
- Craig, C. J., Verma, R., Stokes, R., Evans, P., & Abrol, B. (2018). The influence of parents on undergraduate and graduate students' entering the STEM disciplines and STEM careers. *International journal of science education*, 40(6), 621-643. <https://doi.org/10.1080/09500693.2018.1431853>
- Faber, M., Unfried, A., Wiebe, E. N., Corn, J., Townsend, L. W., & Collins, T. L. (2013). Student attitudes toward STEM: The development of upper elementary school and middle/high school student surveys. In the *Proceedings of the 120<sup>th</sup> American Society of Engineering Education Conference*.
- Guzey, S. S., Harwell, M., & Moore, T. (2014). Development of an instrument to assess attitudes toward science, technology, engineering, and mathematics (STEM). *School Science and Mathematics*, 114(6), 271-279. <https://doi.org/10.1111/ssm.12077>
- Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2014). *Multivariate data analysis* William C. Black. 7<sup>th</sup> ed. Harlow: Pearson Education Limited.
- Hanson, S. L., & Krywult-Albańska, M. (2020). Gender and access to STEM education and occupations in a cross-national context with a focus on Poland. *International Journal of Science Education*, 42(6), 882-905. <https://doi.org/10.1080/09500693.2020.1737341>
- Hasanah, U. (2020). Key Definitions of STEM Education: Literature Review. *Interdisciplinary Journal of Environmental and Science Education*, 16(3), e2217. 1-7. <https://doi.org/10.29333/ijese/8336>
- Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural equation modeling: a multidisciplinary journal*, 6(1), 1-55. <https://doi.org/10.1080/10705519909540118>
- Karagoz, Y. (2016). SPSS and AMOS 23 Applied Statistical Analyzes. Ankara: Nobel Academic Publishing., Turkey.
- Kelley, T. R., & Knowles, J. G. (2016). A conceptual framework for integrated STEM education. *International Journal of STEM Education*, 3(1), 11. <https://doi.org/10.1186/s40594-016-0046-z>
- Kier, M. W., Blanchard, M. R., Osborne, J. W., & Albert, J. L. (2014). The development of the STEM career interest survey (STEM-CIS). *Research in Science Education*, 44(3), 461-481. <https://doi.org/10.1007/s11165-013-9389-3>
- Kurban, E. R., & Cabrera, A. F. (2020). Building readiness and intention towards STEM fields of study: using HSLS: 09 and SEM to examine this complex process among high school students. *The Journal of Higher Education*, 91(4), 620-650. <https://doi.org/10.1080/00221546.2019.1681348>
- Leung, A. (2020). Boundary crossing pedagogy in STEM education. *International Journal of STEM Education*, 7, 15, 1-11. <https://doi.org/10.1186/s40594-020-00212-9>
- Li, Y., Wang, K., Xiao, Y., & Froyd, J. E. (2020). Research and trends in STEM education: a systematic review of journal publications. *International Journal of STEM Education*, 7, 11. <https://doi.org/10.1186/s40594-020-00207-6>
- Luo, T., Wang, J., Liu, X., & Zhou, J. (2019). Development and application of a scale to measure students' STEM continuing motivation. *International Journal of Science Education*, 41(14), 1885-1904. <https://doi.org/10.1080/09500693.2019.1647472>
- Maltese, A. V., & Tai, R. H. (2011). Pipeline persistence: Examining the association of educational experiences with earned degrees in STEM among US students. *Science education*, 95(5), 877-907. <https://doi.org/10.1002/sce.20441>
- Margot, K. C., & Kettler, T. (2019). Teachers' perceptions of STEM integration and education: A systematic literature review. *International Journal of STEM Education*. 6:2 <https://doi.org/10.1186/s40594-018-0151-2>
- Merrill, C. (2001). Integrated technology, mathematics, and science education: A-quasi experiment. *Journal of Industrial Teacher Education*, 38(3), 45-61. Retrieved from <https://scholar.lib.vt.edu/ejournals/JITE/v38n3/merrill.html>
- Paul, K. M., Maltese, A. V., & Valdivia, D. S. (2020). Development and validation of the role identity surveys in engineering (RIS-E) and STEM (RIS-STEM) for elementary students. *International Journal of STEM Education*, 7, 45, 1-17. <https://doi.org/10.1186/s40594-020-00243-2>
- Sadler, P. M., Sonnert, G., Hazari, Z., & Tai, R. (2012). Stability and volatility of STEM career interest in high school: A gender study. *Science education*, 96(3), 411-427. <https://doi.org/10.1002/sce.21007>
- Sanders, M. (2009). Integrative STEM education: primer. *The Technology Teacher*, 68(4), 20-26.
- Schermelleh-Engel, K., Moosbrugger, H., & Müller, H. (2003). Evaluating the fit of structural equation models: Tests of significance and descriptive goodness-of-fit measures. *Methods of psychological research online*, 8(2), 23-74. Retrieved from <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.509.4258&rep=rep1&type=pdf>
- So, W. W. M., Zhan, Y., Chow, S. C. F., & Leung, C. F. (2018). Analysis of STEM activities in primary students' science projects in an informal learning environment. *International Journal of Science and Mathematics Education*, 16, 1003-1023. <https://doi.org/10.1007/s10763-017-9828-0>
- Tabachnick, B. G., & Fidell, L. S. (2012). *Using multivariate statistics* (6<sup>th</sup> ed.) New York: NY: Pearson Education Inc.
- Tyler-Wood, T., Knezek, G., & Christensen, R. (2010). Instruments for assessing interest in STEM content and careers. *Journal of Technology and Teacher Education*, 18(2), 345-368. Retrieved from <https://www.learntechlib.org/p/32311/>
- Unfried, A., Faber, M., Stanhope, D. S., & Wiebe, E. (2015). The Development and Validation of a Measure of Student Attitudes Toward Science, Technology, Engineering, and Math (S-STEM). *Journal of Psychoeducational Assessment*, 33(7), 622-639. <https://doi.org/10.1177/0734282915571160>
- Whitcomb, K. M., Kalender, Z. Y., Nokes-Malach, T. J., Schunn, C. D., & Singh, C. (2020). A mismatch between self-efficacy and performance: Undergraduate women in engineering tend to have lower self-efficacy despite earning higher grades than men. *arXiv preprint arXiv:2003.06006*. Retrieved from <https://arxiv.org/abs/2003.06006>
- Yamak, H., Bulut, N., & DüNDAR, S. (2014). The impact of STEM activities on 5<sup>th</sup> grade students' scientific process skills and their attitudes towards science. *Gazi Eğitim Fakültesi Dergisi*, 34(2), 249-265.

## Appendix 1

Items and factor loading of the sub-factors of the survey for the secondary school students

	Item Numbers	Items	S	T	E	M	
S	1	SC14	I like to attend more science classes	.81			
	2	SC3	I like science classes	.76			
	3	SC13	I like to participate in project studies on science	.75			
	4	SC1	I like to make a career in science field	.73			
	5	SC15	I can do an advanced study in science field	.73			
	6	SC5	I like to solve problems related to science class	.72			
	7	SC4	I work hard for science classes	.70			
T	8	TC9	If I choose a career in technology field, I may be more successful		.82		
	9	TC13	I like to attend more technology classes		.77		
	10	TC12	I can do an advanced study in technology field		.77		
	11	TC14	I like to participate in project studies on technology field		.73		
	12	TC1	I like to make a career in technology field		.72		
	13	TC8	If I choose a career in technology field, I may earn much more money		.72		
	14	TC11	If I choose a career in technology field, I may make my family happier		.72		
E	15	TC10	If I choose a career in technology field, I may work for happiness of people		.71		
	16	EG7	I like to participate in projects on engineering field			.83	
	17	EG8	I like to attend more engineering classes			.82	
	18	EG9	I try to follow new developments in engineering field			.80	
	19	EG10	I can do an advanced study in engineering field			.78	
	20	EG17	I like reading scientific books and journals on engineering field			.75	
	21	EG18	I like to watch documentary about engineering field			.74	
	22	EG1	I like to make a career in engineering field			.73	
	23	EG6	I like to learn operation principles of machines and electronic devices			.71	
	24	EG4	I can develop new and creative ideas in engineering field			.68	
M	25	EG5	I like to repair machines and electronic devices			.68	
	26	MT3	I like mathematics classes				.85
	27	MT5	I like to solve mathematics problems				.84
	28	MT9	I can do an advanced study in mathematics field				.81
	29	MT8	I like to attend more mathematics classes				.81
	30	MT7	I like to participate in projects on mathematics field				.79
	31	MT1	I like to make a career in mathematics field				.79
	32	MT2	I can take high scores in mathematic classes				.76
	33	MT4	I work hard for mathematics classes				.76
	34	MT16	I like reading scientific books and journals on mathematics field				.71
Cronbach's Alpha of the sub-factor			.86	.88	.91	.93	
Eigenvalue			3.81	4.47	5.85	5.57	
Percentage of explained variance			11.21	13.15	17.20	16.38	





# Impact of a One-Off Demonstration on the Use of ICT in the Teaching of Andragogy Students on Their Change of Attitude Towards the Use of ICT in Education

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**Abstract:** The research study deals with the issue of attitudes towards the use of ICT in the education of andragogy students. As a method of research, we chose a three-year experiment. The study first surveyed 224 students in andragogical fields – future educators - in order to discover input factors like identifying their relationship to ICT, skills, experience in the field of ICT and frequency of the use of ICT at work. The study further examines four separate variables, representing three dimensions of attitudes (cognitive, conative and emotional) towards the use of ICT in education – the conviction to use ICT in their teaching, the opinion on the impact of the use of ICT on the understanding of curriculum, the opinion on the impact of the use of ICT in teaching and education itself and the tendency to act to recommend the use of ICT in teaching to their colleagues. In the university teaching of students itself, using the didactic method of AIDA on a mathematical problem, the experimental group is the subject of a demonstration of the use of ICT in empirical verification of the results of the task, as opposed to a control group that does not use ICT in teaching. Specifically, the representation of results in MS Excel and the empirical verification of results in a Python-created program are used. The research aims to determine the impact of the demonstration of a one-off use of ICT in teaching on the change of dimensions of attitude towards the use of ICT in education represented by separated variables. Their rate is measured by a 10-point bipolar scale. The results show p value ( $p < 0.05$ ), which provides evidence that a one-off demonstration of the use of ICT in the teaching of andragogy students is a factor that statistically significantly influences these dimensions of attitude towards the use of ICT in education and thus its overall change, regardless of the gender of the students. The three-year research study confirmed these results in an aggregated experimental group of 112 respondents who were compared with the same aggregated control group.

*Keywords:* ICT in education, Python, AIDA method, attitudes towards the use of ICT in education.

## Introduction

The issue of the use of ICT in education is extensive. Due to the rapid expansion of the use of ICT in all areas of education in recent decades, it has not been enough to form a uniform methodology for the teaching of ICT (Takada et al., 2020). The concept of the use of ICT in teaching can be understood in two ways: ICT as a teaching support tool for mediation of information (e.g., video usage, data projector, mobile devices, internet for searching, etc.) or as a tool for the understanding of curriculum or tool for solving the problem (modelling in applications, creative creation of multimedia content, use of robots, virtualization of reality, simulation, etc.). Teachers, adult educators, lecturers, education advisers and education managers (henceforward we generally use only the term “educators” for all roles) are subject to ever-higher requirements in the field of ICT management and its use in teaching. There are also many concepts of digital competencies, such as DigComp (European Digital Competence Framework 2.0) (Vuorikari et al., 2016). This model works with eight levels of competence from beginner to expert. The aim is for future standardisation of jobs; for example, an employer will be able to say that he requires a certain level of competence. Technological Pedagogical Content Knowledge (TPCK) is one of the general frameworks of the basic knowledge needed to perform the teaching profession. Koehler et al. (2013) seek to apply the TPCK model in the preparation of future teachers. They verify their approach at the Learning Technology Through Design course. In it, students of different specializations learn to prepare (create) ICT-based tutorials together. They propose their own course focused on specific

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content, a project implementing a specific teaching activity, a website, etc. Students work here in teams in which the roles of all three specializations (TPC) are represented. Together, under the guidance of lecturers, they seek mutual intersections to include all possible views in the resulting work (Brdička, 2009).

It is clear that mere knowledge of ICT is not a sufficient condition for its active use in teaching. If we consider the evolution of teaching methods in the context of the transition from behaviourism, cognitivism and constructivism to connectivism (Siemens, 2005), we come to the paradigm of teaching methods as a comprehensive approach using various sources. And at this point, it is necessary to distinguish the instructional and constructive approach to teaching methods. It is the constructive methods that are more closely linked to the use of ICT as a tool for understanding of curriculum or solving problems. Brdička (2004) aptly points out "that the most important thing for teachers is to understand what is the most effective way of deploying technologies using different teaching procedures. Since it is easier for the instructive, the emphasis must nowadays be mainly on constructive procedures. Only a teacher successfully through the stage of empathy can reach a successful end to the process, i.e., to the innovation itself. At this last stage, it is his task to customize the outline and change his working methods for real." Managing ICT and integrating it into teaching therefore requires certain mastery, knowledge and skills. However, the concept of Education 4.0 in the concept of Kursch and Veteška points to other factors that should be considered to make the use of ICT in education innate by future educators (Kursch and Veteška, 2019). According to them, the factors of initiating their outburst, enthusiasm for the cause and engagement are also important. As part of the university training of andragogy students, these factors could be a trigger for further action in this area. Many studies are looking at the positive effects of the use of ICT in teaching, both for students and teachers (Hardman, 2019; Mlambo, Rambe and Schlebusch, 2020; Coklar, 2013; Cok, 2016; Genlott and Grönlund, 2016); Willis et al., 2019; Hammond, 2017, Garzón et al., 2020); Eger et al., 2020; Chang, Tu and Hajiyev, 2019; Wang, Tigelaar and Admiraal, 2021; Eksail and Afari. 2020), however there are not many studies examining how to induce educators to change attitudes towards the use of ICT, in terms of understanding its true added value in teaching itself from a didactic point of view and increasing their motivation to use ICT in teaching. For example, Tomczyk et al. (2020a) concluded based on research that teachers tend to be more of "techno-optimists". Hanafi et al. (2017) addressed the reasons for the low motivation of university students to participate in the ICT use course in teaching (e.g., due to a lack of experience in ICT). His experimental study examined the impact of the new augmented reality mobile application (MARLA) on the motivation of students to attend an ICT university course. The research consisted of 120 non-technical undergraduates specializing in social sciences with an average age of 19.5 years. They were divided into an experimental group and a control group. The dependant variable was the motivation of students to learn and independent variables were the method of learning and gender. The experimental group used the MARLA app on their mobile devices to adopt one of the course topics – ICT competencies, while the control group used a similar application on their desktop computers. An analysis of covariance was performed which showed that boys were more motivated than girls using a mobile app. On the other hand, no effect attributed to the method of learning was observed. The authors concluded that it is likely that a mobile educational tool can be used to help non-technical college students learn with greater motivation, but its success will depend on proper planning and implementation considering the different needs of boys and girls.

Although the use of ICT in education is very extensive and widely discussed, there are currently many meta-studies that bring undetected discoveries in this area. Zhang, Basham and Yang (2020) conducted a meta-study where he identified and synthesized 71 empirical studies related to the implementation of personalised learning conducted between 2006 and 2019. Meta-study shows positive effects of the use of ICT in personalization of teaching, both for students themselves and teachers. The following technologies appeared in the studies under review: web-based adaptive learning systems, intelligent tutoring systems, educational computer games, virtual reality systems, computerized adaptive assessments, mobile applications and multimedia tools for digital storytelling. In conclusion, it notes that personalisation of learning with the help of ICT is by no means a simple task that can be solved by short-term research or intermittent implementation. Personalisation of teaching with the help of ICT will require decades of joint efforts by different stakeholders to bring a promising innovation of education to reality. Talan (2020) conducted a meta-study of the effects of mobile learning. The main purpose of this meta-study was to determine the impact of mobile learning on students' learning performance. One hundred four studies conducted between 2009 and 2019 that met the criteria for inclusion were subjected to meta-analysis. The study sample consisted of 7 568 participants. Results showed that the influence of mobile learning did not change students' learning performance based on the level of education and the period of implementation but changed the study performance based on the subject ( $p < 0.05$ ). This interesting finding confirms that mobile learning effectively targets the content of a particular subject and can increase students' learning

performance, probably by increasing their motivation and due to mobile platforms being easily available.

Eksail and Afari (2020) also found links between teachers' attitudes towards ICT and their use in teaching. His research concluded that the perception of the usefulness of the use of ICT in teaching can improve attitudes towards the use of ICT. A very interesting research of the attitude towards ICT in education was also carried out by Tomczyk et al. (2020b), who tried to answer the question "How does the attitude to New Media influence the evaluation of a new e-learning platform among current and future teachers?" One of his conclusions was that a positive attitude to media in one area of use, e.g., private, is linear with a positive attitude in another area. Snijders et al. (2018) attempted to predict where the use of ICT in the educational process will go. Based on the knowledge from his studies, he predicts that the role and position of the educator will change. Thanks to the massive use of ICT, the traditional approach to teaching is expected to be just one of many ways of education.

### Research Review (in Brief)

Since our department is preparing teachers (our andragogy students are or will be teachers, teachers, adult educators, principals and other roles), we have tried, within our possibilities, to conduct research that would answer the research problem P, what is the effect of a one-off demonstration of the use of ICT in teaching andragogy students on their change of attitude towards the use of ICT in the field of education. That is why we have formulated the following three research questions:

- Does a one-off demonstration of the use of ICT in university teaching influence the opinion of andragogy students about the impact of the use of ICT on the understanding of curriculum and education and learning itself?
- Does a one-off demonstration of the use of ICT in university teaching influence the immediate conviction of andragogy students to use ICT in their future teaching?
- Does a one-off demonstration of the use of ICT in university teaching influence the inclination to act to recommend to your colleagues the use of ICT in teaching?

Our choice of a demonstration was to use ICT as a tool for the understanding of curriculum or solving the problem. We were particularly interested in whether the use of ICT, namely the use of MS Excel in data processing and a short Python program in empirical verification of the results of a mathematical task, can have an impact on the change of three dimensions of attitude towards the use of ICT in education. When determining variables, we draw from the theory of attitudes and their dimensions in personality psychology (Nakonečný, 2009, p. 235). The first variable for us is the conviction of students of andragogy to use ICT in their future teaching (their personal emotional fixed opinion about the inclusion of ICT in teaching). This variable represents an emotional dimension (in short, we will call this variable "personal use"). The second variable is the opinion of andragogy students about the impact of the use of ICT in teaching on the understanding of curriculum (in short, we will call this variable "understanding"). This variable represents a cognitive dimension. The third variable is their opinion on the impact of ICT use on education and learning itself (in short, we will call this variable "teaching". This variable also represents a cognitive dimension. The fourth variable is the tendency to act to recommend the use of ICT in teaching to their colleagues (in short, we will call the variable "recommendation"). This variable represents a conative (behavioral) dimension. Recalling the fundamental fact, our research does not have the ambition to examine these variables in a sophisticated way, but to compare their initial value corresponding to the initial state of students and their final value corresponding to the state after the experiment. The research focuses on finding a change in attitude towards the use of ICT in education (or changes in individual dimensions of attitude as a complex phenomenon). With appropriate questions, we check these variables in control and experimental groups before a demonstration of the use of ICT in teaching and thereafter. The variables "personal use", "understanding", "teaching" and "recommendations", which carry the meanings of the dimensions of attitude towards the use of ICT in education in general, cannot be accurately measured, and therefore we choose a relative comparison of their measurement according to the bipolar 10-point scale so that we can easily check their change. We tried to find out whether an appropriate one-off demonstration of the use of ICT in teaching for students of andragogy – current and future educators (in this case, modelling the real situation using a written program that engages these students) will change their dimensions of attitudes towards the use of ICT in education, i.e. the rate of our four separate variables. Our research only measures variable change based on a one-off external stimulus. Nevertheless, in the event of a positive change, it may result, for example, in increasing the chances of andragogy students using ICT in their future practice or changing their long-term views on the use of ICT in education. However, the results should clearly tell us whether the inclusion of the demonstration of the use

of ICT in the teaching of andragogy students will affect their attitude towards the use of ICT in education.

Summing up our research, its starting point is not only past studies more or less confirming the positive effects of ICT on education, self-education and learning, and studies on the effects of ICT use on future teachers, but above all the concept of external influence on changing a person's attitude. We draw from the theory of attitudes from personality psychology (Nakonečný, 2009). Our external impetus is the demonstration of the actual use of ICT within the university lecture, primarily focused on didactic methods. To what extent this simple innovation can be an important trigger for the immediate influence of a change in attitude towards the use of ICT in education is the aim of our research. Digital competence theories are the ethical framework for determining the initial assessment of andragogy students. We find out the initial level of knowledge and skills, the relationship to ICT, but also the frequency of ICT use. We also base our research on the concept of Veteška and Kursch (2018), who summarize that for the success of education in the context of Education 4.0, important factors are "passion for a particular cause" and engagement. And it is these factors that may be related to the phenomenon we are investigating – the change of students' attitudes based on their own experience. The advantage of our research is that our students do not primarily study mathematics or ICT, but andragogy and didactics, so we aim primarily at finding a change in attitude towards the use of ICT in education in an unprofessional group.

## Materials and Methods

A total of 224 students of master's and bachelor's programmes in adult education at the Faculty of Education of Charles University in the Czech Republic participated in the research over a period of 3 years (2018, 2019, 2020). The participants of the experiment are in our terminology from the introduction "educators" and in the experiment, we will also synonymously call them respondents. The experiment was conducted a total of 8 times in 16 homogeneous groups. The groups were always chosen according to the participants of lectures of programs under andragogical programs according to the possibilities of the university, and if there were more participants in the control group or vice versa, the responses in this group were reduced according to random selection to the number of smaller groups. The groups thus met the homogeneity criteria in terms of the program studied, gender and number of respondents. Table 1 shows the parameters of each group. For the experiment, one of the groups was always experimental and one control. The control group held a seminar aimed at explaining the unconventional didactic method of AIDA on the example of a mathematical problem in the case of the birthday paradox (The birthday paradox is nothing new, more so, for example, in (Al-Khalili, 2012)), but the teaching did not use ICT as a support tool. The experimental group had the same seminar with the same task, but using ICT, namely empirical modelling of the birthday paradox using a simple Python program and modelling in the MS Excel spreadsheet program. For our experiment, we then aggregated all the results of the questionnaire, which was carried out before and after the experiment, into one final control group, consisting of 112 respondents, composed of all sub-control groups and one resulting experimental group of 112 respondents, consisting of all sub-experimental groups (see Table 1).

**Table 1**  
*Parameters of each group*

Group	men	women	SUM	Year	Degree Program
1 control	3	12	15	2018	Bachelor
2 experimental	3	12	15	2018	Bachelor
3 control	4	10	14	2018	Bachelor
4 experimental	4	10	14	2018	Bachelor
5 control	3	9	12	2019	Master
6 experimental	2	10	12	2019	Master
7 control	2	5	7	2019	Master
8 experimental	2	5	7	2019	Master
9 control	2	6	8	2019	Master
10 experimental	3	5	8	2019	Master
11 control	3	13	16	2019	Bachelor
12 experimental	5	11	16	2019	Bachelor
13 control	5	18	23	2020	Master
14 experimental	8	15	23	2020	Master
15 control	9	8	17	2020	Master
16 experimental	9	8	17	2020	Master
<b>SUM</b>	<b>67</b>	<b>157</b>	<b>224</b>	<b>n/a</b>	<b>n/a</b>

The input data was composed of data from all 112 respondents of the resulting control and experimental groups. By homogeneity of the sub-groups, we guaranteed the overall homogeneity and representativeness of the sample and by merging the sub-groups we achieved the necessary size and sample. We thus created one large control group and one large experimental group consisting of responses from all respondents.

In the experiment, we distinguish four input variables that determine the overall relationship of respondents to ICT, their ICT experience and skills, and four variables researched for which we find the degree of change in attitude towards the use of ICT in education in the experiment. When examining input variables, we considered the concepts of TPCK (Koehler et al., 2013) and DigComp (Vuorikari et al., 2016). We are aware of the different relationship of respondents to ICT and the different initial knowledge and skills in this area. However, it would be very difficult for our research to find out in detail the position of respondents within TPCK and DigComp, or to carry out a deeper assessment, especially for time reasons. Levels of ICT competencies of university students in the Czech Republic, Poland and Slovakia were researched by e.g., Eger et al. (2018) in his comprehensive study. That is why we chose the simplified model and tried to identify four essential input variables for all respondents in all our groups. These variables are related to ICT (positive vs negative), estimation of their ICT skills (excellent vs insufficient), experience in the use of ICT in teaching or education (extensive vs none) and frequency of ICT use in their current work or their studies (very common vs. not at all). Here we base our ideas on Eger et al. (2018), who, based on research, has concluded that “frequencies of ICT use for school and leisure-related tasks are crucial determinants of students’ ICT competence”. We used a 5-point Likert range to determine the rate of these input variables. Based on the inspection and check-up of input variables, we can detect possible correlations or dependencies on our variables under investigation, as well as possible anomalies in data or non-standard deviations, for example, due to prejudice. We have separated all variables so that our experiment can be repeated at any time, which is why we describe in great detail the AIDA method used and accurately describe the demonstration of the use of ICT for the experimental group.

Before listing specific cases, we provide a short description of the AIDA method (from Attention, Interest, Desire and Action) in teaching. Polk (2018) in his study using the AIDA method demonstrated its positive effects in education. In Table 2, this method is described. The AIDA method in education and the creation of e-learning courses are also used by some commercial organizations (e.g., B-online learning, see <https://bonlinelearning.com/using-the-aida-model-to-get-buy-in-elearning/>). It can be understood as a didactic method taken from marketing, which, in combination with the use of digital technologies, can arouse the interest of students or pupils in the problem, and itself create an engaging atmosphere in teaching, which can be applied in the introduction to the problem, new teaching or project learning. By combining this method using digital and communication technologies, we can achieve synergistic effects that increase the overall learning efficiency of students and pupils.

**Table 2**  
*AIDA method in education*

Phase	Phase objective
<b>Attention</b>	The aim is to create a stir among students or pupils. It can be inferred, for example, by a riddle, a suitable question, a description of a paradox, a description of a shocking discovery. This phase is always an input phase and should not be too long.
<b>Interest</b>	The aim is to arouse interest in the given problem, the subject, the task. This stage always follows the stage of attention and is intended to develop it. It is a process of explaining, clarifying a problem, a curriculum, or a project, but not showing its solution. The inducement of interest may be gradual, so this phase is aimed at clarifying the whole problem in detail.
<b>Desire</b>	The goal is to induce desire. At this stage, students and pupils should move to a state where they want to solve the problem, master the curriculum, figure out the essence of the matter or start the project.
<b>Action</b>	The aim of this phase is that students and pupils will take action. That they will create solutions for the problem, for example, using ICT to start implementing the project, mastering and managing the curriculum. They will begin to broaden their horizons and continue to ponder the problem on their own.

Our andragogy students are also taught this method as a didactic tool. In our experiment, we teach the AIDA method on the problem of the birthday paradox, which is suitable, for example, in the teaching of combinatorics or as a complement to the teaching of probability. However, it also points to a paradox in the estimation by quick-thinking (Kahneman, 2011). It can be used to explain the dysfunction of intuition in seemingly simple tasks. Many students will remember such tasks for life, and therefore they are suitable for the introduction to the issue of paradoxes. In our experiment, all sixteen groups learn all phases of the method, but the last phase of the method – action – is accompanied only by a paper and pencil calculation in eight control groups. For eight experimental groups, ICT is used to the maximum extent possible in the last phase of the method – action. The full use of ICT as a didactic tool is incorporated into the action phase. The first action of educators in all groups is therefore a mathematical calculation. For this, a simple calculator is enough, but only for one  $n$  at a time. This ends the control groups. Experimental groups continue modelling case for different  $n$  and educators are assigned a modelling task in the MS Excel spreadsheet program. In Figure 1, you can see very well the results of this modelling, solutions for different  $n$ . Educators realize that the probability does not grow linearly, and even at 47 people, it reaches a staggering 95%, which often inspires astonishment.

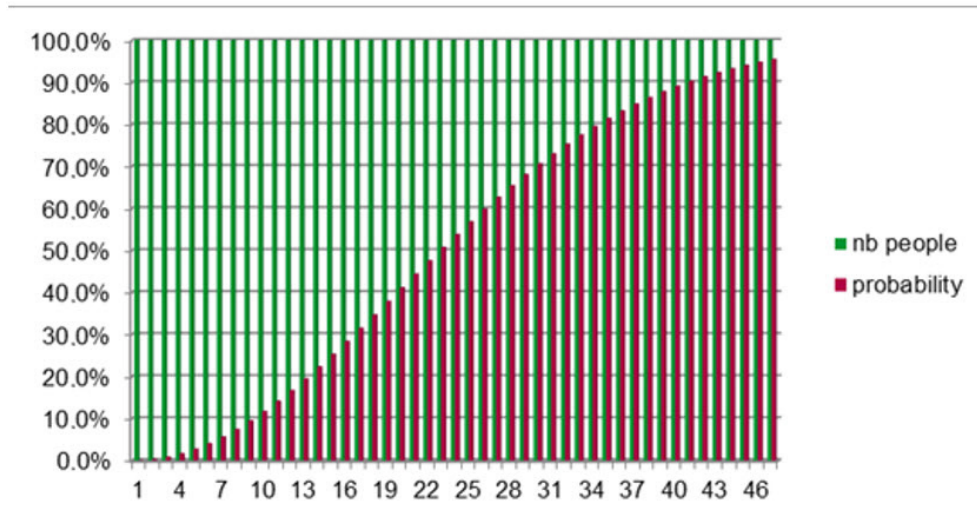


Figure 1. Solving the birthday paradox task for different  $n$  (“nb” means “number of”).

From our experience, we still meet students who, despite the mathematical calculation mirrored in the Excel table, doubt it. This task is counter-intuitive, so it is advisable to use another ICT tool for empirical verification. For example, there is a widely used tool – Python programming language. For our task, we have used the Python programming language in the Jupyter (<https://jupyter.org/try>) online environment, which requires no installation and can be operated online on the web. For modelling via the Python program created by us, we can enter the number of randomly selected people and the number of repetitions of the experiment with this group. Such a model induces a real situation. Below is a program that is written in such a way that even students who do not program themselves can trust it and understand it. Therefore, it is a good idea to explain the program line by line, preferably using embedded notes.

```

importing random #loading module to generate random numbers
people = int(input("number of people selected:")) #setting number of groups of people from the
keyboard
attempt = int(input("count retries:")) #setting number of attempts from the keyboard

match = 0 #initiation number of birthdays matches at the beginning zero match

for i in range(attempt): #cycle conducting experiments
    b = [] #set b days of birth of randomly selected people
    for y in range(people): #cycle fulfilling set of dates of birth (order of days in the year)
        day = random.randint(1, 365) #random date selection
        if day in b: #if date already exists in the set,
            match += 1 #then one match is added

```

```
break #a goes on another try
b.append(day) #else date is assigned to set b at the end

print(f'In {attempt} attempts, {match} could be found")
print(f'In {attempt} attempts, match ability was {match*1000//attempt/10} %") #writes off test results
```

Students can then try to enter different number of attempts and groups online. For example, for n=10 to 80. Table 3 shows the results of the outputs of the program for different n.

**Table 3**  
*Results of randomly selected groups of people who matched birthdays*

experiments/people	n=10	n=23	n=30	n=60	n=80
<b>100</b>	11.0%	46.0%	73.0%	98.0%	100.0%
<b>1000</b>	11.3%	51.6%	68.7%	99.5%	100.0%
<b>10000</b>	11.8%	51.1%	70.9%	99.4%	99.9%
<b>100000</b>	11.6%	50.6%	70.4%	99.4%	99.9%

Such verification can no longer be doubted, and the proof is valid. In this example, the use of ICT for teaching is also a demonstration of a powerful tool that we would find very difficult to supersede in real life. One hundred thousand attempts in one minute were an unthinkable dream decades ago. But why did we choose the AIDA method? Why did we use the role of the birthday paradox? We wanted to minimize any negative effects of an inappropriately chosen method that does not in itself appeal to students, that will be boring or untested. This method, combined with an unconventional role that carries a paradox, guarantees a high motivation of andragogy students and their maximum interest. As a result, we are very likely to exclude other unwanted factors that could act as other variables representing disturbing elements.

For research questions, we set the following zero hypotheses:

HA0: Demonstration of the use of ICT in the teaching of andragogy students does not affect their opinion on the impact of ICT use on education and learning itself.

HB0: Demonstration of the use of ICT in the teaching of andragogy students in teaching does not affect the convictions of andragogy students to use ICT in teaching.

HC0: Demonstration of the use of ICT in the teaching of andragogy students in teaching does not affect their inclination to act to recommend the use of ICT in teaching to their colleagues.

HD0: Demonstration of the use of ICT in the teaching of andragogy students does not affect their opinion on the impact of the use of ICT on the understanding of teaching.

Finally, in Figure 2, we present a framework diagram of our experiment, including capturing the entire experiment process. The method for measuring input variables was a questionnaire using a 5-point Likert scale. The method for measuring the variables under study during the experiment was the bipolar 10-point scale. It is a scale that can measure the dimensions of the respondent's attitude towards ideas, concepts, subjects, people, etc. A non-parametric test for categorical variables – goodness of fit test – was selected as a test statistic. The same methodology was used for all divided groups in all 3 years. As a criterion for changing the overall attitude towards the use of ICT in education in respondents, we chose the condition that we reject at least three out of four zero hypotheses. Otherwise, we will consider the attitude towards the use of ICT in education unchanged. The research tool of initial assessment as well as of experiment part was designed by the researcher according to his previous studies (Veteška and Kursch, 2018). The tool shows internal coherence. Initial assessment includes 4 variables of evaluation and shows coherence – McDonald's  $\omega = 0.745$ ; Cronbach's  $\alpha = 0.766$ ; Gutmann's  $\lambda_6 = 0.776$ . The experiment part includes 1 item – attitude towards the use of ICT in education which consists of 4 variables (representing dimensions of attitude) and shows coherence before experiment – McDonald's  $\omega = 0.896$ ; Cronbach's  $\alpha = 0.893$ ; Gutmann's  $\lambda_6 = 0.886$  and after experiment – McDonald's  $\omega = 0.902$ ; Cronbach's  $\alpha = 0.899$ ; Gutmann's  $\lambda_6 = 0.877$ .

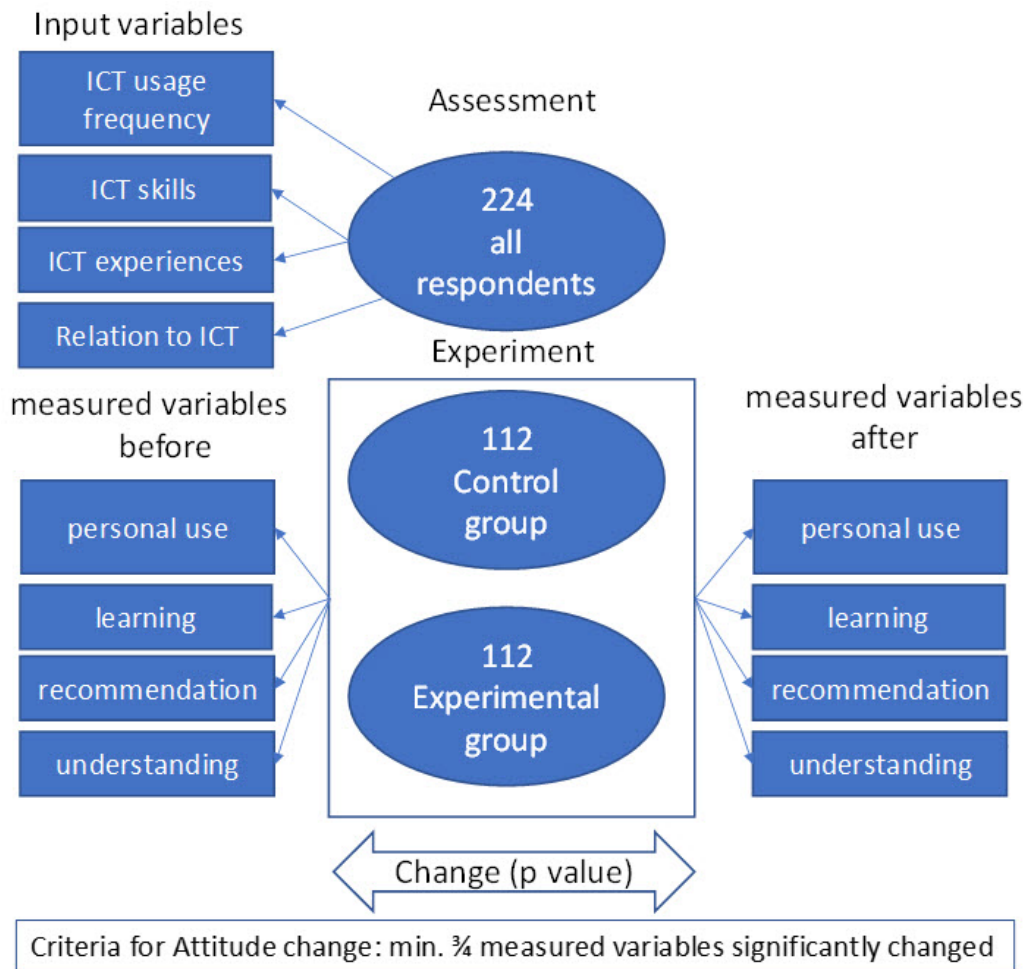


Figure 2. Experiment description schema.

## Results

First, we present the results of our respondents' input responses. Respondents commented on questions about their relationship to ICT, estimation of their skills in the use of ICT, their experience in the use of ICT in teaching or education and the frequency of use of ICT in their current job. Answers to all 4 key questions are categorized in Figure 3. 5-point Likert scales with the following key were chosen for the assessment: skills (1 – excellent 5 – insufficient), attitude to ICT (1 – very positive 5 – very negative), experience (1 – extensive 5 – none), frequency of ICT usage (1 – very often 5 – not at all).

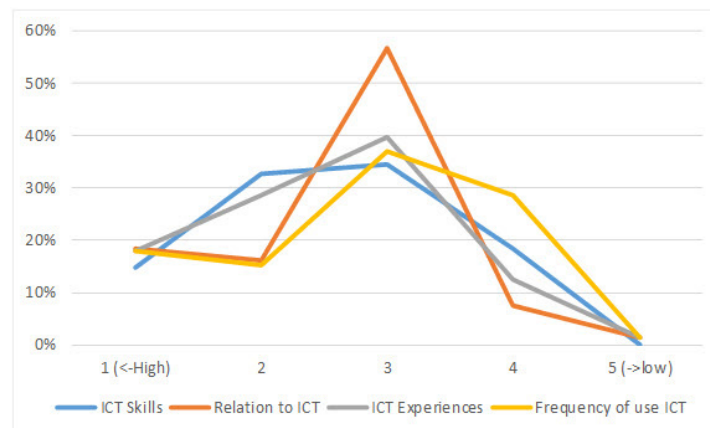


Figure 3. Respondents' responses to their ICT skills, the experience of using ICT in teaching, frequencies of use of ICT in work and their relationship to ICT (scale 1–5).

The input responses allowed us to find possible disruptive phenomena or prejudices of respondents that could then explain the extreme values measured during the experiment. In our case, however, we found no anomalies. Table 4 shows relations among input variables via similarity matrix.

**Table 4**  
*Similarity matrix (created with IBM SPSS Statistics based on Pearson's correlations)*

<b>Proximity Matrix</b>				
Rescaled Correlation between Vectors of Values				
	relation	skills	experience	frequency
relation	1.000	0.588	0.807	0.815
skills	0.588	1.000	0.782	0.741
experience	0.807	0.782	1.000	0.830
frequency	0.815	0.741	0.830	1.000

However, from the results of the experiment, we found very interesting findings regarding our researched dimensions of the attitude of andragogy students on the use of ICT in the education. As a test hypothesis of the experiment, we used the Chi-Square goodness of fit test. We calculated the comparison of expected and measured values for each individual before and after using a goodness of fit test. The expected test value (considered for each individual as their initial pre-teaching input value) and the experimental measured value (the actual value measured after teaching in both the control and experimental groups for each individual) were measured on a 10-point bipolar scale. The degrees of freedom were 111, as each respondent is part of one value. Critical values match levels  $\alpha=0.05$ ,  $\alpha=0.01$  and degrees of freedom:

$$\chi^2_{0.95}(111) = 136.591$$

$$\chi^2_{0.99}(111) = 148.571$$

In the experimental group, we look for all values (Values  $\chi^2$  motivation (162.439), understanding (136.140), recommendations (139.870), impact (160.619)) greater  $\chi^2 > \chi^2_{0.95}(111)$  which imply the difference between the detected and expected frequency is statistically significant at a significance level of 0.05. On the contrary, for the control group, all values (Values  $\chi^2$  motivation (75.276), understanding (22.117), recommendations (16.582), impact (73.267)) are  $\chi^2 < \chi^2_{0.95}(111)$ . We therefore refuted 3 zero hypotheses HA0, HB0 and HC0. Table 5 shows the results of the goodness of fit test for the experimental and control groups.

**Table 5**  
*Research results for experimental and control groups for our examined factors (p values)*

ICT in teaching (p values)	Personal use	Understanding	Recommendations	Learning
control group	0.9962	1.0000	1.0000	0.9978
experimental group	0.0011	0.0528	0.0332	0.0015

Assuming that the variables under examination give us an equal indication of a change in attitude towards the use of ICT in education and the fulfilment of our established refutation criterion of at least three out of four zero hypotheses, we can conclude that we have demonstrated a statistically significant positive effect of the demonstration of the use of ICT in teaching of andragogy students on their change in attitude towards the use of ICT in education. In more detail, a statistically significant positive effect on the change in the cognitive dimension of attitude towards the use of ICT in education – an opinion on the impact on education and learning itself, a positive effect on the change in the conative dimension of attitude towards the use of ICT in education – a tendency to recommend to colleagues the active use of ICT in teaching and education, and a change in the emotional dimension – the conviction to use ICT more in their future teaching. Only for the influence on the change in the cognitive dimension of attitude towards the use of ICT in the education of andragogy students – the opinion on the impact of the use of ICT in teaching on the understanding of curriculum was  $p > 0.05$ . Therefore, we could not unequivocally refute

the zero hypothesis HD0, but it should be noted that p, in this case, was  $p = 0.0528$ , i.e., we are at the limit of statistical significance. According to our established criteria, we confirmed the overall signification of the ICT demonstration in teaching on changes in attitudes towards the use of ICT in education among andragogy students. Furthermore, we found that for students who reported their relationship to ICT itself as negative or very negative (input variable), the demonstration of teaching using ICT did not have a significant impact on their change in attitude towards the use of ICT in education. This has been confirmed for all dimensions. This was also the case for respondents reporting little or insufficient skills, very little experience of using ICT in teaching and low frequency of ICT use in teaching. Our results confirming statistical insignificance for these groups are given in Table 6. These findings could indicate that a negative relationship with ICT and a lack of skills may indicate resistance to a change in attitude towards the use of ICT in education, even after demonstrating the use of ICT in teaching, its effectiveness and positive aspects. However, for such conclusions, we would need further research aimed at finding this correlation or causality.

**Table 6**

*Research results for the experimental group where respondents gave a negative relationship to ICT, low or insufficient ICT skills, poor experience using ICT in teaching and low frequency of ICT use in teaching (p values)*

ICT in teaching (p values)	Personal use	Understanding	Recommendation	Learning
4.5 ICT relationship	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
4.5 usage rate	n/a	$p > 0.05$	$p > 0.05$	$p > 0.05$
4.5 skills	n/a	$p > 0.05$	$p > 0.05$	$p > 0.05$

A complementary fact was that there are no significant statistical differences between men and women. For completeness, we conducted coherence of questionnaire of psychometric properties to verify the reliability of the entire test, covering the researched variables containing responses according to the 10-point bipolar scale, which was 0.893 before and 0.899 after experiment. Cronbach's Alpha has been calculated classically with the omission of one item. IBM SPSS Statistics (build 1.0.0.1447) software was used for the calculation as well as all other values mentioned in part of research tool description. Descriptive statistics of our responses before and after the experiment are given in Table 7.

**Table 7**

*Descriptive statistical parameters of the responses (values 1–10) to be answered before and after the experiment was conducted in both groups.*

Item	N	Sum	Average	Median	Modus	Sd	Var	Min	Max
before 1	224	1202	5.37	5	5	2.10	4.39	1	8
before 2	224	1119	5.00	5	5	1.71	2.93	2	8
before 3	224	1319	5.89	5	8	2.27	5.17	1	10
before 4	224	1294	5.78	5	5	2.27	5.17	1	10
after 1	224	1370	6.12	6	5	1.99	3.97	1	9
after 2	224	1362	6.08	6	5	1.96	3.82	2	10
after 3	224	1569	7.00	7	5	2.36	5.59	1	10
after 4	224	1556	6.95	6	5	2.39	5.72	1	10

Let us review the goals we set at the beginning of this study. Research questions related to the research problem P, what is the influence of a one-off demonstration of the use of ICT in teaching of andragogy students on change of their attitude towards the use of ICT in the field of education.

- Q1: Does a one-off demonstration of the use of ICT in university teaching influence the opinion of andragogy students about the impact of the use of ICT on the understanding of curriculum and education and learning itself?

Our findings show that demonstration of the use of ICT in teaching influences a change in the

cognitive dimension of attitude towards the use of ICT in the education of andragogy students about the impact of ICT use on the understanding of curriculum and education and learning. Change of opinion on the impact of the use of ICT on education and learning itself can be statistically significant ( $p < 0.05$ ), for the experimental group the point value of the 10-point bipolar scale increased by 1.879 on average, as opposed to the control group, where it increased by only 0.375 points. The knowledge of the change of opinion on the understanding of curriculum through the use of ICT also supports a positive answer to the question regarding the decisive role of ICT to understand the current problem, although we cannot confirm statistical significance ( $p > 0.05$ ) based on the results. However, we cannot rule out a high degree of influence, because in this case, the experimental group on the 10-point bipolar scale gave values in an average of 1.805 higher after the experience with ICT in solving the task of the birthday paradox (measured  $p$  was 0.0528).

- Q2: Does a one-off demonstration of the use of ICT in university teaching influence the immediate conviction of andragogy students to use ICT in their future teaching?

In the question aimed at determining the influence of the change in the emotional dimension of students' attitudes towards the use of ICT in education – the conviction to use ICT in their future teaching based on their own experience with it and its use in didactics teaching, the results were unequivocal. The change in conviction in the use of ICT in their future teaching in the experimental group represents a higher increase in the 10-point bipolar scale compared to the control groups. On average, the score for the experimental group increased by 1.097 points compared to the control group, where it increased by 0.389 points. Here we could point out that the conviction to use ICT in teaching increases after a specific demonstration and understanding the importance of using ICT in a didactic process as opposed to ignorance of such an impact in control groups. Nevertheless, we remind you that based on the analysis of input variables, this effect is measurable only for students with a positive relationship to ICT.

- Q3: Does a one-off demonstration of the use of ICT in university teaching influence recommending the use of ICT in teaching to their colleagues?

The change in the conative dimension of the attitude towards the use of ICT in education – the tendency to act to recommend the active use of ICT in teaching and education to their colleagues confirms to us that, together with the change of conviction in the use of ICT in their teaching, the tendency to act to recommend the use of ICT tools in teaching to their colleagues increases. It is an interesting phenomenon that one demonstration was enough to increase the recommendation rate. The 10-point bipolar scale averages 1.831 change for the experimental group versus 0.380 for the control group. This finding may point to the fact that careful and fair teaching of the use of ICT for andragogy students positively influences the spread of good practices among other educators. We can also assume that thanks to the recommendations, the expansion of effective ICT teaching tools among educators – educators and adult educators across many disciplines of teaching can happen.

## Discussions

Based on the results of our experiment, using statistical analysis, we confirmed 3 hypotheses that there are positive links between the demonstration of the use of ICT in teaching and the change of attitude towards the use of ICT in education by andragogy students. This means that the use of ICT in the teaching of future educators will lead to a higher use of ICT in their own teaching and to the promotion of the use of ICT in education. This result is in line with some recent previous studies on the positive effects of ICT use in teaching (Hardman, 2019; Mlambo, Rambe and Schiebusch, 2020 ; Willis et al., 2019; Hammond, 2017; Garzón et al., 2020) and attitude towards the use of ICT in education (Eksail and Afari, 2020; Tomczyk et al., 2020b).

Our study should be evaluated in terms of objectivity and consider any valid objections to the research itself. In our research, we paid attention to the separation of variables. The groups were homogeneous in terms of the distribution of men and women of the same number of respondents and in terms of the diversity of the input parameters of our respondents – andragogy students. The selection of individual participants of the group was random from the beginning, included in the given university division by subject. We looked at three dimensions of attitude towards the use of ICT in education, represented by four variables: the conviction to use ICT in teaching; opinion on the impact of ICT use on the understanding of curriculum, opinion on the impact of the use of ICT on education and learning itself; and the inclination to act to recommend it to their colleagues in teaching. We also looked at the input parameters of respondents' relationship to ICT as a default state to separate possible relations with the student's prejudices on ICT as such or to eliminate abnormalities. We asked test questions to identify four

factors to experimental and control groups at the same time, a week before their experimental teaching and a week after their teaching. Thanks to the minimum time interval, we eliminated other possible influences during this time, but at the same time, we eliminated the immediate effect of responses “just” after experimental teaching. Separation and balancing with the time interval thus performed ensured the maximum possible independent results. Thanks to the anonymization of respondents, it is also impossible to object to the possible influence of authorities. Furthermore, we used the most attractive content of didactics to eliminate any lack of interest of respondents in the content of the study. The relevant objection may then be the introduction of respondents to the subject of the research and its purpose, but this should not affect the differences in responses, since even the initial state was detected after the initial communication, but with a gap of weeks, since the communication was carried out at the beginning of the term.

What we see as a key challenge for our research is whether our identified influence is permanent or only temporary, induced by a positive experience and a one-off teaching experience. We would certainly suggest further research in this area, regarding this issue. It would be advisable to repeat our experiment to confirm the results mentioned by us and to carry out new research to determine the permanence of positive influence. ICT certainly has a great future in education and learning. In particular, new ICT such as augmented reality, virtual reality has promising results in its use in the field of education and learning. Therefore, we should go down the path of increasing digital competencies (Hanafi et al., 2017) of our future educators and adult educators. The development of digital competences is essential for the application of the individual within the profession, but also in social and civic roles (Veteška, 2016). It will take constant improvement, adaptation and rational approach so that we do not get into extreme positions, prevent inefficiencies and help build an environment in which all educational participants feel comfortable working with ICT and their practical applications on this path.

## Conclusions

Our results have come to explicit conclusions that confirm the positive effects of the demonstration of the use of ICT in teaching to change the attitude of andragogy students on the use of ICT in education. These changes are particularly reflected in students with an “a priori” positive relationship to ICT. Our specific recommendation is to focus in particular on demonstrating the use of ICT in education in the areas of real-world modelling using simple programs or applications, simulation of real events in virtual laboratories, solving complex problems using advanced big data processing tools and dynamic visualizations of the results of real-world variable relationships. If our research were to be repeatedly confirmed, we could realize that, from a didactic and methodological point of view, demonstration of the use of ICT in teaching as a tool for understanding of curriculum or solving the problem is an effective means of influencing changes in attitudes towards the use of ICT in education, and thus an argument to include these demonstrations across university subjects for andragogy students (andragogy students, educators, education advisers, education managers, principals and others). The results could give impetus to the more frequent inclusion of the use of ICT in university teaching of future and current educators to enrich this teaching with interesting and effective didactic ICT tools, which will then be promoted by university graduates themselves across many disciplines and specializations.

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### Conflict of interests

The author declares no conflict of interest.

## References

- Al-Khalili, J. (2012). *Paradox: the nine greatest enigmas in physics: the nine greatest enigmas in physics*. Broadway: Transworld Digital.
- Brdička, B. (2004). Vliv technologií na inovaci výukových metod [The influence of technology on the innovation of teaching

- methods] [Online]. In *Spomocník.net*. Retrieved March 29, 2021, from <http://www.spomocnik.net/2004/12/vliv-technologie-na-inovaci-vyukovych.html>
- Brdička, B. (2009). Článek teoreticky popisující model integrace technologií do portfolia kompetencí učitelů [An article theoretically describing the model of technology integration into the portfolio of teacher competencies] [Online]. In *Metodický portál RVP.CZ*. Retrieved from <https://spomocnik.rvp.cz/clanek/10641/INTEGRACE-TECHNOLOGII-PODLE-MODELU-TPCK.html>
- Chang, C. T., Tu, C. S., & Hajiyev, J. (2019). Integrating academic type of social media activity with perceived academic performance: A role of task-related and non-task-related compulsive Internet use. *Computers & Education*, 139, 157-172. <https://doi.org/10.1016/j.compedu.2019.05.011>
- Čok T. (2016). ICT-supported language learning tools for Chinese as a foreign language. *Journal of Elementary Education*, 9(3), 103-120. Retrieved from <https://journals.um.si/index.php/education/article/view/353>
- Çoklar, A. N. (2013). Areas affected most by the students from the ICT focused technological transformations and its effects on education. *Mediterranean Journal of Social Sciences*, 4(9), 249-252. <https://doi.org/10.5901/mjss.2013.v4n9p249>
- Eger, L., Klement, M., PISOŇOVÁ, M., & Petrová, G. (2018). Different user groups of university students and their ICT competence: evidence from three countries in central Europe. *Journal of Baltic Science Education*, 17(5), 851. <https://doi.org/10.33225/jbse/18.17.851>
- Eger, L., Tomczyk, Ł., Klement, M., PISOŇOVÁ, M., & Petrová, G. (2020). How do first year university students use ICT in their leisure time and for learning purposes? *International Journal of Cognitive Research in Science Engineering and Education*, 8(2), 25-52. <https://doi.org/10.5937/IJCRSEE2002035E>
- Eksail, F. A. A., & Afari, E. (2020). Factors affecting trainee teachers' intention to use technology: A structural equation modeling approach. *Education and Information Technologies*, 25(4), 2681-2697. <https://doi.org/10.1007/s10639-019-10086-2>
- Garzón, J., Baldiris, S., Gutiérrez, J., & Pavón, J. (2020). How do pedagogical approaches affect the impact of augmented reality on education? A meta-analysis and research synthesis. *Educational Research Review*, 31. <https://doi.org/10.1016/j.edurev.2020.100334>
- Genlott, A. A., & Grönlund, Å. (2016). Closing the gaps – Improving literacy and mathematics by ICT-enhanced collaboration. *Computers*, 99, 68-80. <https://doi.org/10.1016/j.compedu.2016.04.004>
- Hammond, M. (2017). Online collaboration and cooperation: The recurring importance of evidence, rationale and viability. *Education and Information Technologies*, 22(3), 1005-1024. <https://doi.org/10.1007/s10639-016-9469-x>
- Hanafi, H. F., Said, C. S., Wahab, M. H., & Samsuddin, K. (2017, August). Improving students' motivation in learning ICT course with the use of a mobile augmented reality learning environment. In *IOP Conference Series: Materials Science and Engineering* (Vol. 226, No. 1, p. 012114). IOP Publishing. <https://doi.org/10.1088/1757-899X/226/1/012114>
- Hardman, J. (2019). Towards a pedagogical model of teaching with ICTs for mathematics attainment in primary school: A review of studies 2008–2018. *Heliyon*, 5(5), e01726. <https://doi.org/10.1016/j.heliyon.2019.e01726>
- Kahneman, D. (2011). *Thinking, fast and slow*. New York: Farrar, Straus and Giroux.
- Koehler, M. J., Mishra, P., Akcaoglu, M., & Rosenberg, J. (2013). The Technological Pedagogical Content Knowledge Framework for Teachers and Teacher Educators. In R. Thyagarajan, *ICT integrated teacher education: A resource book* (pp. 2-7). New Delhi: Commonwealth Educational Media Centre for Asia. Retrieved from <http://cemca.org.in/resources/books>
- Kursch, M., & Veteška, J. (2019). Paradigma „Vzdělávání 4.0“ v éře digitalizace a globalizace [Paradigm “Education 4.0” in the era of digitization and globalization]. In J. Veteška (ed.). *Vzdělávání dospělých 2018 – transformace v éře digitalizace a umělé inteligence = Adult Education 2018 – transformation in the era of digitization and artificial intelligence: proceedings of the 8<sup>th</sup> International Adult Education Conference, 11-12th December 2018 Prague* (pp. 15-23). Praha: Česká andragogická společnost.
- Mlambo, S., Rambe, P., & Schlebush, L. (2020). Effects of Gauteng province's educators' ICT self-efficacy on their pedagogical use of ICTs in classrooms. *Heliyon*, 6(4), e03730. <https://doi.org/10.1016/j.heliyon.2020.e03730>
- Nakonečný, M. (2009). *Psychologie osobnosti* [Psychologie osobnosti] (2nd ed.). Praha: Academia.
- Polk, X. L. (2018). Marketing: The Key to Successful Teaching and Learning. *Journal of Marketing Development*, 12(2), 49-57. <https://doi.org/10.33423/jmdc.v12i2.1257>
- Siemens, G. (2005). Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology & Distance Learning*, 2(1), 3-10. Retrieved from [http://www.itdl.org/journal/jan\\_05/article01.htm](http://www.itdl.org/journal/jan_05/article01.htm)
- Snijders, D., van der Duin, P., Marchau, V., & van Doorn, G. J. (2018). Scenarios for ICT-related education: a qualitative meta-analysis. *Journal of Futures Studies*, 23(2), 13-28. [https://doi.org/10.6531/JFS.201812\\_23\(2\).0002](https://doi.org/10.6531/JFS.201812_23(2).0002)
- Takada, S., Cuadros-Vargas, E., Impagliazzo, J., Gordon, S., Marshall, L., Topi, H., ... & Waguespack, L. (2020). Toward the visual understanding of computing curricula. *Education and Information Technologies*, 25(5), 4231-4270. <https://doi.org/10.1007/s10639-020-10127-1>
- Talan, T. (2020). The effect of mobile learning on learning performance: A meta-analysis study. *Educational Sciences: Theory and Practice*, 20(1), 79-103. <https://doi.org/10.12738/jestp.2020.1.006>
- Tomczyk, Ł., Jáuregui, V. C., Amato, C. A. D. L. H., Muñoz, D., Arteaga, M., Oyelere, S. S., ... & Porta, M. (2020a). Are teachers techno-optimists or techno-pessimists? A pilot comparative among teachers in Bolivia, Brazil, the Dominican Republic, Ecuador, Finland, Poland, Turkey, and Uruguay. *Education and Information Technologies*, 1-27. <https://doi.org/10.1007/s10639-020-10380-4>
- Tomczyk, Ł., Martins, V. F., Eliseo, M. A., Silveira, I. F., Cibelle, A., Stošić, L., & Oyelere, S. S. (2020b). How Does the Attitude to New Media influence the Evaluation of a new e-Learning Platform Among Current and Future Teachers?. In *2020 XV Conferencia Latinoamericana de Tecnologías de Aprendizaje (LACLO)* (pp. 1-8). IEEE. <https://doi.org/10.1109/LACLO50806.2020.9381130>
- Veteška, J. (2016). *Přehled andragogiky* [Overview of andragogy]. Praha: Portál.
- Veteška, J., & Kursch, M. (2018). The research on the efficiency of the methods of talent management within organizations. *New Educational Review*, 52(2), 28-42. <https://doi.org/10.15804/ner.2018.52.2.02>
- Vuorikari, R., Punie, Y., Gomez, S. C., & Van Den Brande, G. (2016). *DigComp 2.0: The digital competence framework for citizens. Update phase 1: The conceptual reference model* (No. JRC101254). Joint Research Centre (Seville site). <https://doi.org/10.2791/11517>

Kursch, M. (2021). Impact of a one-off demonstration on the use of ICT in the teaching of andragogy students on their change of attitude towards the use of ICT in education, *International Journal of Cognitive Research in Science, Engineering and Education (IJCRSEE)*, 9(1), 121-134.

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- Wang, J., Tigelaar, D. E., & Admiraal, W. (2021). Rural teachers' sharing of digital educational resources: From motivation to behavior. *Computers & Education*, 161, 104055. <https://doi.org/10.1016/j.compedu.2020.104055>
- Willis, R. L., Lynch, D., Fradale, P., & Yeigh, T. (2019). Influences on purposeful implementation of ICT into the classroom: An exploratory study of K-12 teachers. *Education and Information Technologies*, 24(1), 63-77. <https://doi.org/10.1007/s10639-018-9760-0>
- Zhang, L., Basham, J. D., & Yang, S. (2020). Understanding the implementation of personalized learning: A research synthesis. *Educational Research Review*, 31. <https://doi.org/10.1016/j.edurev.2020.100339>

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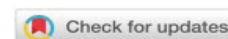
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# Cognitive-Emotional Music Listening Paradigm in Professional Music Education

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**Abstract:** Music education is an important factor of students' development. The positive effect of music training is evident in all areas, from the intellectual, psychomotor to social and emotional ones, and therefore music classes in the music school should focus both on music making and on experience, understanding and evaluating music, as well as on expressing one's own ideas, feelings and thoughts. In ear training classes it can be achieved through the area of music listening. Didactical initiatives of the 19th and 20th century contributed to the recognition of the advantages of the auditory approach, while technological innovations allowed the practical application of music listening. Although there are examples that point to fostering the emotional experience in music classes, music listening is still focused on giving assignments of cognitive type and learning about music components. Some exceptions pertain to the application of multimodality in music teaching using both musical and extra-musical areas. The paper is aimed at pointing to the value of the cognitive-emotional music listening and to the possibilities it opens in ear training classes. The cognitive-emotional music listening focuses on experiencing, understanding and appreciation of classical music aimed at shaping students' worldview and improving their music competences. It can be achieved by the multimodal and interdisciplinary approach to a musical piece. Students learn about the musical-historical context of the emergence of a piece in a given time and circumstances, about the composing approach and the theoretical and harmony features of the work, they develop their musical and critical thinking, make music, and evaluate both music and their own achievements. Repeated listening to a musical piece or excerpts from it, observing and familiarizing with the piece from different perspectives and discussion about the piece and experience after listening make it possible to better understand the piece and its specifics, as well as to discover and improve one's own self and accept others and the different.

*Keywords:* art education, cognitive-emotional music listening, ear training, music school.

## Introduction

The education system of the countries that succeeded Yugoslavia preserved the same concept: primary, secondary and higher education. Besides the compulsory primary education, free art education is also available. It is legislatively regulated, and available to every child under equal conditions, and its aim is to foster and improve children's intellectual, emotional, social, as well as creative and aesthetic development. Aims of art education focus on experience, knowledge acquisition, skill development and understanding of various aspects of arts and works of art, ultimately aimed at their competent evaluation ([Nacionalni kurikulum za umjetničko obrazovanje, 2017](#)). The macroconcepts it is based on focus on knowledge acquisition and development of art skills, understanding the language of art as well as to creative expression on the one hand and, on the other, on students' social and emotional development underlining the fundamental life values such as respect for differences, patience, tolerance and empathy. Within music education, students acquire musical knowledge and skills, make music, promote music through public activity and improve musical culture of the environment the school works in. Additional music education influences their musical as well as overall development, whereby a particular attention should be devoted to the emotional and social component.

Recent research points to the positive aspects of music education and involvement in music as an essential activity in personality formation. Besides the acquisition, development and improvement of music competences, involvement in music also fosters the development of multiple intelligences

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(Armstrong, 2006; Gardner, Kornhaber and Wake, 1999). Studies conducted by Gibson, Folley and Park (2009), Hille et al., (2011), Schellenberg (2011), Schellenberg and Mankarious (2012) point to the direct association between involvement in music and improvement of IQ. Association between musical training and cognitive abilities are highlighted by Schellenberg (2005, 2016), who also points out that music develops spatial abilities, which is also confirmed by Bilhartz, Bruhn and Olson (1999), Hetland (2000), Rauscher (2002) and Zafranias (2007). Findings of the research by Chan, Ho and Cheung (1998) and Ho, Cheung and Chan (2003) indicate association between music and verbal memory. Schwarzer, Lippke and Luszczynska (2011) notes that music curriculum in schools leads to the improvement of students' visual and aural memory. Gruhn (2002) and Zachopoulou, Tsapakidou and Derri (2004) claim that the beneficial effect of music lessons reflects on children's psychomotor development, while Schellenberg (2016) notes that musical training also influences the development of students' social skills. Musical training also contributes to the development of self-esteem, self-confidence and self-control (Rickard et al., 2013), empathy (Kirchner and Tomasello, 2010; Rabinowitch, Cross and Burnard, 2013), self-confidence and motivation (Hallam, 2010). It is enhanced by, e.g., students' joint music making, when the attention focuses on the group and when every individual has the opportunity to develop their social and emotional skills, kindness, support, empathy, understanding and respect. Development and improvement of students' abilities, knowledge and skills, learning of values and establishing a critical distance in terms of adopting and permanently bonding to music, culture and art is the goal of music education and, at the same time, the pedagogical and educational function of music classes. In doing so, models and strategies of delivering classes, intensity and duration of education certainly affect the final outcome.

Experience, understanding and evaluation of music by expressing one's own ideas, feelings and thoughts also relate to teaching fundamental life values. Vidulin (2015, 2020), and Vidulin, Plavšić and Žauhar (2020) see the direct possibility to achieve this in the area and activity of music listening, which influences children's full development. Music listening arouses senses and reaches affective layers leading to the emotion utterance. The experience of music in its entirety in the atmosphere of relaxation contributes to the group integration, decreases inhibition, improves interpersonal relations, and binds emotion and creativity uniting in the aesthetic.

Although listening is the most natural way to experience and learn music, it is actually a form of work which was the last to be inaugurated in the practice of music teaching. Designing a serious strategy of teaching by means of music listening was allowed only by the technological advancement of the society. Although there is a well-elaborated didactical approach to music listening in school, in the omnipresence of music in the 21<sup>st</sup> century the teacher is facing new challenges: how to motivate students, increase their attention and contribute to the acceptance of art music.

### **Ear training: from rational reflection to auditory vividness**

Development of music pedagogy is mostly a result of historical and other circumstances and norms which were generally accepted in a given moment and at a given place, rather than a sequence of logical events or consideration. Some initiatives had a continuity of development regardless of the speed of their dialectic path, while others have been lost forever in the maze of millennium-long expanses (Kazić, 2013). The passage through centuries of efforts and endeavours of music pedagogy and music teaching methods testifies of the multiplicity of procedures, methods and directions, from the elementary ones such as training the children voice and music education by means of children songs, through various didactic, mnemotechnic and graphic aids, to the attempts to foster and raise interest in music in musical and non-musical way.

During the 19<sup>th</sup> century, numerous innovations were inaugurated in the area of music teaching. Most authors, regardless of different didactical solutions, always suggest that the auditory way of implementation should precede the visual one, i.e. point to the primarily auditory perception of musical terms before the adoption of graphic marks. The fact that it was only paying lip service is confirmed by the insight into numerous music textbooks and manuals of the time, which primarily and almost as a rule began with music literacy before any other auditory event in the class. Knowledge gained by means of active listening to music models and examples was also a rarity, except when teachers were able to perform something on their own.

Frenchman Wilhem was one of the most influential music pedagogues of the 19<sup>th</sup> century. He proposes the auditory approach in music education, before mastering music notation and learning theory, i.e. performing. His approach encompasses the identification of elementary sound structures such as notes (pitch level, loudness, source of sound, etc.) and possibly the perception of the size of intervals.

Wilhem's contemporaries, Swiss journalist and composer Nägeli and Bavarian teacher Pfeiffer were the first to use the term ear training in their textbook *Gesangbildungslehre nach Pestalozzis Grundsätzen* (1810) which, among other procedures, introduced the musical dictation as a form of work. De Momigny also emphasizes the need for music to be judged by listening, since the auditory perception is more reliable than sheet music (Stefanija, 2008). Although ear training cannot be reduced only to listening training, it is still a significant point of origin, since it implies a kind of guided listening to a melody. The famous composer Schumann also affirmatively spoke of the comprehensive listening and, generally, of the need to listen to a musical piece several times (1849, aphoristic Advice to Young Musicians 39, 47, 50, 52, 67), since he believed that a piece cannot be evaluated after a single listening.

The concept of musical upbringing was inaugurated into the system of music education after 1918, and the development of musical abilities was understood as a road toward the permanent musical thinking, with a particular importance being attached to the upbringing of conscious listening with auditory perception. It was believed that the clarity of musical structure while listening can emerge only through conscious experience and sensory ability; thus, refinement of musical ear was achieved by means of intellectual and rational reflection, without expressing the emotional, and even the aesthetic component.

The perception of any sound phenomenon with a rational explanation are the basic principles of Battke's pedagogy and are based on the auditory apperception. The term apperception, in the sense of the perceptively conscious inclusion into the existing content of consciousness, was first used by German philosopher, psychologist and teacher Herbart. Contrary to the ontological viewpoint of Battke, who perceived music as it is, differentiated from the subjective experience, Jaques-Dalcroze is decidedly against such a reduction of perception and response in education to a common level. He believes that musical communication should proceed first through the auditory sense and instinct, and only then through intellect, with rhythmic as the most potent and most vivid element in music (Jacques-Dalcroze, 1921). The framework of Dalcroze method (Eurythmics) provides and develops a series of subtle procedures based on auditory cognition and rhythmic. Music listening proceeds in real time and with the teacher's live performance. The performance is often based on improvised parts performed by the teacher during the class, changing the tempo and melorhythmic structures consequent to the group's responses, which in turn reinforces attention, experience, perception and thinking. Dalcroze's idea is significant because it is a completely original way and perhaps the first time in the history of the group music classes to provide the opportunity for continuous listening to music and only then, on this basis, to proceed with other teaching activities.

Music listening which results in an experience, perception, emotion, analysis, cognition, thinking, aesthetic judgment etc., and which should be the fundamental disposition on the road to the adoption of musical knowledge was not realistically feasible before technology allowed it. During the second half of the 20<sup>th</sup> century, audio formats began to be used, and music could be listened to every day/the whole day and in any space. Thus Bresgen in his classes relies upon audiotapes and phonograph records (Bresgen, 1960), which opens a completely new approach and new possibilities for teaching music with music in a real time, while music still goes on.

In Alt's concept of music education, in-class music listening has a completely specific and significant place. He believed that technical progress, which allowed the presence of music in every home, poses a potential threat, since such an approach to non-selective listening in a sense make people passive and distant from the artistic in music. Alt recognizes and points to the central task of music education, i.e. to the objective evaluation of a work of art. Alt (1968) believes that music listening makes it possible to learn about different styles and genres, which in turn can lead to a high-quality aesthetic evaluation, which distinguishes the mature listener. In the procedure of in-class music listening, he distinguishes three stages, from passive listening to sound sensations (notes, rhythms, harmonies etc.), which create a picturesque interaction and arouse emotions, through aesthetic listening during the active/guided music listening, to the inspirational listening, when music begins to inspire. Since sound/sonority is a symbol of mental states and music is a need or prerequisite for certain mental events, the prerequisite for inspirational music listening, according to Alt, is a particular degree of its understanding. It is therefore necessary to lead students toward the listening and perception that can objectively evaluate and categorize a multitude of musical impressions in everyday life.

The second half of the 20<sup>th</sup> century witnessed an evident development of curricula where music obtained its syllabi with objectives, tasks and expected outcomes. They proposed contents which are considered basics of musical culture and the art of music. They also design various methods for its learning and strategies for teaching at different educational levels. The objective of teaching music that primarily pertained to singing by ear (in the didactic, rather than artistic sense), and then to singing by notes aimed at gaining music literacy (Vidulin, Plavšić and Žauhar, 2020) is gradually changing. Music

listening is taking an increasingly significant place. In this respect it is possible to follow both didactical instructions and evaluation of music listening as an approach in education.

## **Music listening in curricula and didactical manuals in the Western Balkans countries**

In the mid-20<sup>th</sup> century, music listening gained its place and has been present in music classes in the Western Balkan countries as one of music areas ever since. Overview of the curricula for teaching music in primary schools from 1946 to 2019 (see Vidulin, Plavšić and Žauhar, 2020) reveals that music listening was introduced in music classes in 1948, though it depended on the capacities of schools which, in the post-war period, were not equipped with teaching aids. In the post-war years, records and radio programmes were somewhere listened to in order to allow students to become familiar with music literature, which was a valuable contribution to music listening in schools. Curricula suggested pieces for listening and illustration of particular musical phenomena and concepts, and the attention was focused on getting familiar with music and musicological contents. At present, music listening also primarily focuses on the musical piece and its components, which results in the focus on the cognitive dimension of teaching music.

In one of the first music didactical manuals, Požgaj points out that the teacher can occasionally organize separate classes of music listening, which focus on the perception of the expressive elements of music, and the expression of impressions aimed at forming an aesthetic judgment. For Požgaj, the primary function of music listening is an experience of a work of art, which is always of sentient nature, and therefore the importance is attached to preparation for listening, which will allow stronger impression on listeners. He distinguishes activities of preparation for listening, the experience of musical piece, understanding, expressing impressions, and judging and teaching. Požgaj was certainly one of the first music pedagogues who comprehensively considered all aspects of music teaching, including the establishment of active listening, at the time when radio receivers were still a rarity. In a new edition of Metodika [Didactics], Požgaj brings tape recorders and phonographs in the modern classroom of the time, together with the tape library and records library, radio receiver and television set. In these different circumstances, he believes that music listening is compulsory in every class, at least for a few minutes, and starting from the first grade. He links the sentient experience and mental activity, which he believes to imply the perception and comparison of the elements of musical expression, imagination, musical memory, analytic-synthetic understanding of musical form and forming aesthetic judgment.

Rakijaš distinguishes music listening by means of a mechanical device from listening in one's own, live reproduction, which he considers more valuable in the educational sense. He distinguishes pieces from musical literature according to attributes used to describe music with: fantastic music, dramatic music, emotional music, programme music, etc. According to Rakijaš, music listening fosters the experience, which is the consonance of emotional and mental activity. Plavša, Popović and Debeljak believe that music listening is empirical work. They focus attention on the piece components, aimed at grasping its formal structures, which in turn indicates the complexity of a creative act. In a similar way, Andreé, Baroševčić, Basrak, Krulanović, Kučukalić, Ludvig-Pečar, Požgaj & Stevković suggest that when listening to music it is important to focus attention on the characteristics of a musical piece, i.e. on its expressive components. Such an approach will allow students to become more familiar with the music they probably do not listen to in their spare time.

For Rojko (1982), work on musicological contents is part of the cognitive process while listening to music. At each repeated listening, instructions and assignments are given and the music is perceived through the prism of analytic-synthetic framework. The importance of giving assignments is also pointed out by Hodžić, who suggests assignments that will allow listening to be careful and active, and children to be focused on the musical contents. The development of students' perceptive abilities of music listening is associated with the entire process of adopting and understanding musical phenomena, so that they can get the opportunity to substantiate their views and opinions on the musical pieces they listened to and shape their aesthetic criteria.

Insight into didactical manuals reveals the tendency to listen to music actively and mostly cognitively. Active listening to a musical piece focused on cognition implies the perception of musical - expressive components and formative structures of a musical piece, and distinguishing musical (theatrical music) types, ways of performance and performing ensembles. Before listening to a musical piece, students are given assignments which motivate them to actively follow, listen to and analyse the music. Perception, auditory identification and distinguishing musical-expressive components are gradually built upon through

education cycles.

Still, it can be observed in the teaching practice that assignments during music listening are identical for every piece, which ultimately does not contribute to its better understanding, and thus acceptance. Since every piece is labelled with a unique musical idiom, it is necessary to insist exactly on its distinctiveness, by which students will recognize it and distinguish it from others, and to emotionally include students in music listening and encourage discussion of emotional experiences and associations that arose due to listening (Vidulin, Plavšić and Žauhar, 2020).

## Multimodal concepts of music listening in schools

Although it primarily focuses on music, music listening can also be viewed in comparison with other musical and extra-musical areas and activities. In this context, we speak of multiple modalities in music teaching. Multimodal approach can spur better achievement and greater motivation (Yu et al., 2010) and allow the creation of more association in experiences (Mayer, 2001).

Novelties in the area of listening to classical music with a multimodal and interdisciplinary approach were introduced by Vidulin (2015; 2017; 2020; Vidulin-Orbanić, 2013). Listening to Music – Music Making (LMM) approach and Stage-English-Music (SEM) concept were designed with the aim of promoting classical music among children and youth, so that they can better understand and accept it. While the LMM approach views music through/with music, SEM is of interdisciplinary character.

LMM approach is based on the immediate connection between music listening and composing and comprises both the cognitive and the emotional context. School-age children's composing is often associated with the knowledge of certain music components which they perceive while listening to musical pieces. The model is specific in that children first get familiar with music through music and then create/compose it. In doing so, the model makes use only of musical activities. Singing and playing, as the most frequent way of connecting music listening with other areas of music directly affect knowledge and skills and enhance emotional reception of music in children.

Exit from the exclusively musical zone is allowed by the SEM concept, which proposes music listening in combination with other, both musical and extra-musical activities and areas. The multimodal approach influences the culture of listening to classical music, familiarizing with it, understanding and accepting it. Students gain knowledge of musical-style periods, of characteristics of a given piece and its artistic values, they get to know the composer and his life, which affects the cognitive and emotional level of teaching. A particular contribution to the concept is provided by drama education and foreign language (English), which influences students' general culture, developing their musical, drama and language skills. Work with students according to the SEM concept emphasizes students' activities and immediate experience. Listening to the world around them and critical thinking develop students' imagination, influence their behaviour, express views, shape beliefs, identify and express emotions whereby children learn about and discover themselves and the world around them.

As the response to the question as to how regular music classes can become and permanently remain an exciting and creative environment, the cognitive-emotional music listening was introduced (Vidulin, Plavšić and Žauhar, 2020). Multimodal interactive ways of work using multimedia are proposed for completing cognitive and emotional tasks which support the children's holistic development.

Cognitive-emotional music listening starts from the assumption that a music piece will be more permanently adopted if children experience and live through it in multiple modalities, and associate everything with their own viewpoints and beliefs. If a musical piece is brought closer to students in a way appropriate for them, with musical and extra-musical stimuli and with their own activity and expression, it will allow easier and faster learning, better understanding and longer-lasting memory, as well as the emotional reception of the music (Dunn, 2008; 2014; Fung and Gromko, 2001; Johnson, 2013).

Another characteristic of the cognitive-emotional music listening is that the same piece is listened to through three levels during a single class, integrally or fragmentarily, depending on its duration. The first listening is exclusively experiential, spontaneous, focused on the emotional reception of the composition and is not guided by specific questions of cognitive type. The middle level of music listening is cognitively oriented, though the emotional context deepens due to the activity that proceeds in parallel to music listening. It is due to the multimodal listening which is characteristic for the second level of music listening that the emotional context is enhanced since students' activity as well as motivation are at a high level. The final listening is not determined in advanced by questions about musical-expressive components. The piece is listened to as a whole. In this stage, cognitive and emotional aspects are united, with the assumption that the experience can be conditioned by a better knowledge of the piece and its

acceptance. In the final listening, which can be relaxing, students shape their impressions of the piece, express their emotions, show the level of knowledge and analytic skills. Repeated listening to a musical piece or its excerpts, observation and familiarization with the piece from different perspectives, as well as the discussion about the piece and the experience after listening make it possible to better understand the piece and its specifics and – we assume – leads to its acceptance.

Since the essential idea of the described models, concepts and approaches is to promote classical music in schools, it is the school of music that should be the right place where music should be presented by means of listening. Having in mind the structure of classes in schools of music, ear training classes should be the most appropriate for this purpose. However, it is not happening, nor are such possibilities considered. Can reasons for this be found in the overburden of ear training classes with the existing contents, teachers' inertness or something else, are questions that could be specifically answered by research in the area of professional music education.

## **Music listening in the context of ear training classes**

Music listening by means of reproduction devices as the youngest form of work in music teaching was introduced in the teaching practice of primary general education schools in the subject music education/training/culture, according to amendments to curricula. Since its introduction, this area was understood as a form of the modernization of music teaching in primary general education schools, and it enriched teachers' work. Learning about the elements of the history of music was less dull if teachers were able to present a couple of audio recordings, and it was exciting for students as well, since at the time many of them did not have the opportunity to listen to music on tapes or records outside the classroom.

In this respect, it can be observed that teaching technology was not used in schools of music until the most recent time, and that therefore ear training classes remained cloaked in traditionalism. We presume that there are several possible reasons for the inertness of music teachers and music pedagogues with respect to modernizing ear training classes by means of introducing new teaching technologies. One of the reasons can certainly involve the very structure of classes, since ear training classes are delivered in a group, as opposed to individual instrument classes. Indeed, from the present perspective, several centuries had to pass from the first organized music teaching in church and guild schools, through classes at conservatories, private lessons, to a form of professional music education such as a structured school of music of the 19<sup>th</sup> century. Even then, music classes typically implied teaching playing or singing.

Ear training classes were inaugurated as a course in the curriculum of Paris Conservatory in 1795 (Kazić, 2013), and in the 19<sup>th</sup> century, this model of music teaching was accepted across both France and Europe. Besides major courses, almost all the conservatories of the 19<sup>th</sup> century had classes in ear training, harmony, counterpoint, sight reading etc. In this respect, ear training classes rounded out their physiognomy relatively fast. Their aims included gaining music literacy and learning elementary theory of music, analytic approach (audible and visual) to interval, triad etc. then sight-singing, rhythm processing, recording musical dictation, possibly learning songs regardless of different didactical viewpoints and solutions. Although the 19<sup>th</sup> and the 20<sup>th</sup> century were certainly fraught with a multitude of didactical ideas, procedures, concepts, manuals, textbooks, collections of examples etc., the basic elements of ear training classes have remained almost the same to this day, which is evident in reviewing recent curricula. Besides, some ear training textbooks of the 19<sup>th</sup> century written by music pedagogues of French tradition, e.g. Panseron, Lavignac, English pedagogues from Curwen's Tonic Sol-fa College, German editions by Hundoegger Tonika-Do-Verlag of the early 20<sup>th</sup> century can even today be successfully used and are somewhere used in ear training classes.

With respect to the elements of in-class music listening (if an instrument was available), these could be only the elementary melodic or rhythmic structures which were focused on recording musical dictation, audible perception of an interval, melodic and rhythm structures. Therefore, one cannot describe it as a well-conceived cognitive approach. Such music listening served as an aid for doing assignments, rather than being aimed at truly getting closer to the essence of music by means of sensory cognition. No emotion was involved since the assignments of the musical dictation type or analytic identification of given structures were entirely of ontological nature. The previously cited German ontologist Herbart dealt with the issues of form in arts which, according to him, is the entirety of all relations that, for instance, in a musical structure comprises of notes, perhaps rhythm, etc. Its aesthetic value is not subject to a subjective assessment, and therefore to emotion, since aesthetic depends on the relations between content elements which are, in this case, as they are; thus, in their own right. Which relation provides an aesthetic moment, which is good and which is not, is the subject of aesthetics, which in this stage of

education is not necessary. As was already pointed out, it was mostly the ontological moment ear training classes (Kazić, 2019).

Besides the fact that, in the 19<sup>th</sup> and the first half of the 20<sup>th</sup> century, ear training was rounded out in terms of the forms of work, in a way, it closed for possible new approaches and solutions. It was the time of the search for didactical procedures and means, a time of great pedagogical ideas, though also of the focus and system, i. e. a road to technicism (Kazić, 2019). The rationalist use of what had already been tested would provide more modest though perhaps the expected outcomes in teaching music, in the sense that the sheet music is sung as soon and as correctly as possible, or that the musical dictation is recorded as soon and as accurately as possible. It is evident in the numerous textbooks and manuals of the time, whose very titles reveal their authors' megalomaniac aspiration to solve such a complex subject matter of ear training exclusively by means of a system of their own exercises (e.g., from French literature, 1600 Exercices Gradués, Cours Complet d'Éducation Musicale, Cours Complet de Solfège, etc.)

At the time when technological conditions were created for listening to musical examples in the class, ear training classes simply did not allow any space for this activity, or for the idea to possibly incorporate music listening in some of the existing procedures and thus increase the supply. Thus, music listening as a potentially valuable form of work remained exclusively in music classes in general education schools.

In a memorable didactical approach, different from previous ones, Bašić (see Letica, 2014) considers music listening as an essential need in the development of aesthetic sensibility. Music listening is syncretically linked to visual expression, which in the most natural way sensitizes and releases emotionality. In this case, music listening activates children's syncretic expression as a form of the unity of motor, speech and musical/musicality elements (Kazić, 2019). The class usually starts with the music of atmosphere or movement, a major or minor mood, as well as possibly with more complex palettes of the offered sound of a musical phenomenon that the teacher performs on the piano. Thus, it is not listening to the integral piece on a phonograph record, though it is also a way to foster attention and experience. The cognitive component is also used as a feedback, since monitoring children's responses to the musical work provides knowledge of their actual abilities, which makes it possible to use children's dispositions in the further development of their artistic, i.e. aesthetic upbringing.

Didactical manuals for ear training (Grgošević, Kazić, Radičeva, Rojko, Vasiljević) do not consider listening to music examples by means of reproduction devices in any segment. Kazić (2013, 2019) proposes the audio recording as a possibility for work on musical dictations; however, in these instances attention is focused only on the assignment rather than on the well-conceived listening and musical experience of the emotional component of the piece. Neither do the manuals such as 222, 555 izabranih tema za solfeggio [222, 555 selected themes for ear training] (Marković) or even 999 glazbenih tema iz glazbene literature za solfeggio [999 musical themes from musical literature for ear training] (Golčić) open the way for gradual understanding and experiencing a work of art since these are short themes taken out of the context of a whole, or short excerpts from great orchestral forms that are notated monophonic. Such examples can certainly be used for sight singing or playing, or for dictations, but – at this level – they can hardly be experienced and viewed in the context of the entirety of a musical piece. Although Popović suggests that, after singing an example from art music literature in his textbook students hear the entire piece from a phonograph record, the appropriateness of such an approach is debatable. Students are unlikely to find their way and recognize the previously sung theme in the entire sound by listening to the performance of a symphony orchestra.

Certainly, the context of ear training classes does not recognize integral or partial listening to a musical piece as a potential didactical procedure or a possibility to incorporate it as such in another, already existing procedure. This could perhaps confirm the significance of the emotional component in ear training classes, since all modern approaches unambiguously point to the need for synergy between cognitive and emotional in art teaching.

## **Prospects of cognitive-emotional music listening in ear training classes in the primary music school**

Cognitive-emotional music listening has certainly opened the possibility to incorporate this way of listening in other areas, such as ear training. Since the listening is aimed at shaping students' cultural-artistic worldview and at contributing to their aesthetic upbringing, its task is to develop and improve students' musical competences, and the objective is to experience, understand and accept art music, the described postulates can be mapped to the area of ear training as well. The possibility of achieving

the goal is even greater in the music school, since classical music is the focus of work in students' music education, and the number of hours is greater than that of music classes in the general education school. Focus on the cognitive and emotional dimension of music and learning, repeated listening, and multimodal and interdisciplinary approach to a musical piece can be achieved in ear training classes, where it is also possible to foster a humanistic paradigm that leads to students' holistic upbringing and education.

Repeated listening in ear training classes, as well as in music classes in the general school proceeds in stages, and we therefore recognize further similarities in cognitive-emotional music listening between different subjects. The initial listening is emotional and supports the experience of the whole without announcements and stimuli. It is spontaneous and is followed by a discussion about impressions. The middle listening is of cognitive and emotional types. Students are motivated and guided by musical and extra-musical stimuli to experience a musical piece more intensely and get familiar with it. The listening is multimodal, and students participate actively. The final listening, which also sums up the subject matter, is of cognitive-emotional character and spontaneous. The teacher probes the overall impression and encourages various ways of students' expression. Besides learning about the musical-historical context of the emergence of the piece at a given time and space, composing procedure and theoretical and harmonic features of the piece, students develop their musical/musicality thinking, are encouraged to think critically and evaluate the music, as well as to discover and self-realize their own selves.

Together with the described features of the approach, which can be used when delivering teaching units in both general and music school, attention should be paid to the fact that the cognitive approach to listening in the music school is more complex due to the scope of musical knowledge and skills that students should gain in ear training classes. It is for this reason that preparations for work in ear training classes in the primary music school should be based on laws and contents of ear training, although they will be dealt with in a somewhat different way by means of cognitive-emotional listening. When developing the cognitive-emotional listening lesson plans, it is important for teachers to be guided by criteria such as appropriateness for the students' age, as well as the compliance with the curriculum, and to pay a particular attention to studying the musical piece and discovering the message it brings. In this way, the musical piece will become and remain impressive for students and will influence their development, both as musicians and as humane and emphatic persons.

Since research findings of a comprehensive study on the cognitive-emotional music listening have been published in several stages in papers by Vidulin, Plavšić, and Žauhar (2019, 2020), Vidulin and Plavšić (2020), and Vidulin (2020), advantages of the cognitive-emotional approach compared to the standard approach to music listening have been confirmed. In the multimodal approach supported by musical and extra-musical activities, increased interaction and active participation, students were more focused on the musical piece and expressed the desire to listen to it again. Their cognitive and emotional experience helped them to generate a larger number of responses of a broader spectrum which pertained to the cognitive elements, e.g. recognition of musical components, and to emotional elements, e.g. associations to the piece and identification of emotions, as well as the experience of the music. The findings also indicate that the teacher's guidance and the level of students' (inter)activity during the class are decisive for their experience of music listening.

Although the value of the cognitive-emotional music listening has been recognized and proven by research in the primary general education school, many questions remain open. In this respect, answers are expected that will improve the professional music education and provide guidelines related to the role, function and significance of music listening in ear training classes and that pertain to musical dictation, sight-singing, mastering melodic and rhythmic structures, and theory of music. Besides, it will be important to determine guidelines pertaining to the detection of the psychological processes that support the cognitive-emotional music listening in ear training classes, skills and competences allowed by the approach, way of delivering classes and expected outcomes.

Research of the cognitive-emotional music listening in ear training classes will be guided by research findings pertaining to the primary music school, though respecting the specifics of the course in ear training. It is important to find the optimum multimodal interactive methods that will help students to understand, analyse, try out, experience, memorize and accept the piece they listen to, as well as to discover their own selves, enrich their personal and emotional experience.

## Conclusions

Tracking the historical course of didactical initiatives in the area of ear training reveals the tendency to use primarily the audible perception of musical concepts; however, the practical implementation was

a rarity until the emergence of technical devices. Conscious music listening with the audible perception found its place in the mid-20<sup>th</sup> century and has, to this day, mostly been based on intellectual and rational reflections, without expressing the emotional and aesthetic component. Although there are exceptions which point to the association between music listening and rhythmical movement or visual-art expression, and although some music pedagogues also propose the continuous listening, the active and guided music listening and expressing impressions and the emotional experience, focusing attention on the expressive musical components still prevails. The emotional approach to music listening that can be detected in the history of ear training as a formulation or aspiration has not been associated with listening to an actual musical piece, or the listening was linked to a specific assignment.

If music listening is viewed as a possibility that results in an experience, perception, emotion, analysis, cognition, opinion, aesthetic judgment etc., it is apparent that it requires a change in the listening strategy, as well as in its goal. The cognitive characteristics are still important part of learning about music, and therefore giving assignments before music listening can still be considered a good didactical procedure, which motivates students to actively follow, listen and analyse music. However, besides the well-conceived assignments that lead to the cognitive dimension of music listening, it is important to emotionally involve students in music listening and to encourage discussion of emotional experiences, states and associations resulting from the listening.

Though primarily music-oriented, music listening in ear training classes can also be observed in its relationship with other musical and extra-musical areas and activities, in the multimodal and interdisciplinary way. Classical music, which is the foundation of work in the school of music, is experienced and studied mostly by means of musical activities: by singing, playing, listening, all of which influence the development of students' musical knowledge and skills. However, the cognitive-emotional listening deepens this development. Music listening can be incorporated in some of the already existing procedures, music can be listened to repeatedly, integrally or partially, and the expected outcome will encompass both learning about musical phenomena, i.e. better understanding of music, and experiencing and identifying the emotions transferred by the music and states that the listener is in.

Developing lesson plans based on the cognitive-emotional listening, its research in practice and testing its success, all aimed at correcting the objective and tasks of music listening in the music school could be a polygon for modernizing ear training classes. Repeated listening to a musical piece or its excerpt, observing and learning about the piece from different perspectives and discussion of the piece and experience make it possible to better understand the piece and its specifics. A shift away from musical literacy, sight-singing and learning the theory of music, together with musical dictation, audible perception of intervals, chords or a rhythmic structure, which are the end in themselves, toward the cognitive-emotional listening will allow students' development both as musicians and as humane members of social community. By making music, learning, developing skills and expressing their personal viewpoints, beliefs and emotions and accepting others' positions, they will get to know and learn to respect both themselves and others.

### **Conflict of interests**

The authors declare no conflict of interest.

## **References**

- Alt, M. (1968). *Didaktik der Musik: Orientierung am Kunstwerk* [Didactics of Music: Orientation towards the artwork]. Düsseldorf: Pädagogischer Verlag Schwann.
- Armstrong, Th. (2006). *Višestruke inteligencije u razredu* [Multiple intelligences in the classroom]. Zagreb: Educa.
- Bilhartz, T. D., Bruhn, R. A., & Olson, J. E. (1999). The effect of early music training on child cognitive development. *Journal of Applied Developmental Psychology*, 20(4), 615-636. [https://doi.org/10.1016/S0193-3973\(99\)00033-7](https://doi.org/10.1016/S0193-3973(99)00033-7)
- Bresgen, C. (1960). *Die Improvisation* [Improvisation]. Heidelberg: Quelle & Meyer.
- Chan, A. S., Ho, Y. C., & Cheung, M. C. (1998). Music training improves verbal memory. *Nature*, 396(6707), 128-128. <https://doi.org/10.1038/24075>
- Dunn, R. E. (2008). The effect of auditory, visual, or kinesthetic perceptual strengths on music listening. *Contributions to Music Education*, 35, 47-78. Retrieved from <http://www.jstor.org/stable/24127162>
- Dunn, R. E. (2014). Life music as a beginning point: Connecting with the intuitive listener. *The Musical Experience: Rethinking music teaching and learning Online: Oxford Scholarship Online*. Retrieved from <https://static1.squarespace.com/static/561b5fd6e4b0beb4167429b1/t/561ba97be4b0a09ae30575de/1444653435226/Connecting+with+the+Intuitive+Listener.pdf>
- Fung, C. V., & Gromko, J. E. (2001). Effects of active versus passive listening on the quality of children's invented notations and preferences for two pieces from an unfamiliar culture. *Psychology of Music*, 29(2), 128-138. <https://doi.org/10.1177/0305735601292003>

- Gardner, H., Kornhaber, M. L., & Wake, W. K. (1999). *Inteligencija: različita gledišta* [Intelligence: different points of view]. Jastrebarsko: Naklada Slap.
- Gibson, C., Folley, B. S., & Park, S. (2009). Enhanced divergent thinking and creativity in musicians: A behavioral and near-infrared spectroscopy study. *Brain and Cognition*, 69(1), 162-169. <https://doi.org/10.1016/j.bandc.2008.07.009>
- Gruhn, W. (2002). Phases and stages in early music learning. A longitudinal study on the development of young children's musical potential. *Music Education Research*, 4(1), 51-71. <https://doi.org/10.1080/14613800220119778>
- Hallam, S. (2010). The power of music: Its impact on the intellectual, social and personal development of children and young people. *International Journal of Music Education*, 28(3), 269-289. <https://doi.org/10.1177/0255761410370658>
- Hetland, L. (2000). Learning to make music enhances spatial reasoning. *Journal of Aesthetic Education*, 34(3/4), 179-238. <https://doi.org/10.2307/3333643>
- Hille, K., Gust, L., Bitz, U., & Kammer, T. (2011). Associations between music education, intelligence, and spelling ability in elementary school. *Advances in Cognitive Psychology*, 7, 1-6. <https://doi.org/10.2478/v10053-008-0082-4>
- Ho, Y-C, Cheung, M-C., & Chan, A. S. (2003). Music training improves verbal but not visual memory: Cross-sectional and longitudinal explorations in children. *Neuropsychology*, 17(3), 439-450. <https://doi.org/10.1037/0894-4105.17.3.439>
- Jacques-Dalcroze, E. (1921). *Rhythm, music and education*. New York: GP Putnam's Sons.
- Johnson, D. (2013). Creating meaningful music listening experiences with active music making. *Musicworks: Journal of the Australian Council of Orff Schulwerk*, 18, 49-56. <https://doi.org/10.3316/informit.594189376467615>
- Kazić, S. (2013). *Solfeggio: historija i praksa* [Ear training: History and practice]. Sarajevo: Muzička akademija, Muzikološko društvo FBiH.
- Kazić, S. (2019). *Muzička improvizacija u edukaciji: historija i praksa* [Musical improvisation in education: History and practice]. Sarajevo: Muzička akademija u Sarajevu.
- Kirschner, S., & Tomasello, M. (2010). Joint music making promotes prosocial behavior in 4-year-old children. *Evolution and Human Behavior*, 31(5), 354-364. <https://doi.org/10.1016/j.evolhumbehav.2010.04.004>
- Letica, M. (Ed.) (2014). *Vjerujem svakom djetetu – tekstovi iz ostavštine Elly Bašić* [I trust every child – texts from the legacy of Elly Bašić]. Zagreb: GU Elly Bašić.
- Mayer, R. E. (2001). *Multimedia learning*. New York: Cambridge University Press.
- Nacionalni kurikulum za umjetničko obrazovanje [National Curriculum for Art Education] (2017). Zagreb: Ministarstvo znanosti i obrazovanja. Retrieved from <https://mzo.gov.hr/istaknute-teme/odgoj-i-obrazovanje/nacionalni-kurikulum/nacionalni-kurikulumi/531>
- Rabinowitch, T-C., Cross, I., & Burnard, P. (2013). Long-term musical group interaction has a positive influence on empathy in children. *Psychology of Music*, 41(4), 484-498. <https://doi.org/10.1177/0305735612440609>
- Rauscher, F. H. (2002). Mozart and the mind: Factual and fictional effects of musical enrichment. In J. Aronson (Ed.), *Improving academic achievement: Impact of psychological factors on education* (pp. 269-278). New York: Academic Press. <https://doi.org/10.1016/B978-012064455-1/50016-6>
- Rickard, N. S., Appelman, P., James, R., Murphy, F., Gill, A., & Bambrick, C. (2013). Orchestrating life skills: The effect of increased school-based music classes on children's social competence and self-esteem. *International Journal of Music Education*, 31(3), 292-309. <https://doi.org/10.1177/0255761411434824>
- Rojko, P. (1982). *Psihološke osnove intonacije i ritma*. [Psychological bases of intonation and rhythm]. Zagreb: Muzička akademija - Croatia concert. Retrieved from [https://bib.irb.hr/datoteka/567762.P\\_Rojko\\_Psiholoke\\_osnove\\_intonacije\\_i\\_ritma.pdf](https://bib.irb.hr/datoteka/567762.P_Rojko_Psiholoke_osnove_intonacije_i_ritma.pdf)
- Schellenberg, E. G. (2005). Music and cognitive abilities. *Current Directions in Psychological Science*, 14(6), 317-320. <https://doi.org/10.1111/j.0963-7214.2005.00389.x>
- Schellenberg, E. G. (2011). Examining the association between music lessons and intelligence. *British Journal of Psychology*, 102(3), 283-302. <https://doi.org/10.1111/j.2044-8295.2010.02000.x>
- Schellenberg, E. G. (2016). *Music training and nonmusical abilities*. In S. Hallam, I. Cross, & M. Thaut (Eds.), *Oxford library of psychology. The Oxford handbook of music psychology* (pp. 415-429). Oxford University Press.
- Schellenberg, E. G., & Mankarious, M. (2012). Music training and emotion comprehension in childhood. *Emotion*, 12(5), 887-891. <https://doi.org/10.1037/a0027971>
- Schumann, R. (1849). *Album für die Jugend* [Album for young people], Op.68. Hamburg: Schuberth.
- Schwarzer, R., Lippke, S., & Luszczynska, A. (2011). Mechanisms of health behaviour change in persons with chronic illness or disability: The Health Action Process Approach (HAPA). *Rehabilitation Psychology*, 56(3), 161-170. <https://doi.org/10.1037/a0024509>
- Stefanija, L. (2008). *Metode analize glazbe - Povijesno-teorijski ocr* [Methods of music analysis - Historical-theoretical outline]. Zagreb: Hrvatsko muzikološko društvo.
- Vidulin, S. (2015). Korelacija umjetnosti i jezika u svrhu razvoja učenikova znanja i umijeća [Correlation of art and language for the purpose of developing students' knowledge and skills]. In M. Petrović (Ed.), *Sociološki aspekt pedagogije i izvođaštva u scenskim umetnostima* (pp. 189-200). Beograd: Fakultet muzičke umetnosti.
- Vidulin, S. (2017). The "Listening to and Making Music" approach in the function of improving musical understanding. *Glasbenopedagoški zbornik Akademije za glasbo v Ljubljani/The Journal of Music Education of the Academy of Music in Ljubljana*, 145-162. Retrieved from [https://bib.irb.hr/datoteka/932300.Vidulin\\_Listening\\_to\\_and\\_Music\\_Making\\_Approach.pdf](https://bib.irb.hr/datoteka/932300.Vidulin_Listening_to_and_Music_Making_Approach.pdf)
- Vidulin, S. (2020). Music teaching in regular class and extracurricular music activities in Croatia: State and perspectives. *Hungarian Educational Research Journal*, 10(2), 143-154. <https://doi.org/10.1556/063.2020.00015>
- Vidulin-Orbanić, S. (2013). *Glazbeno stvaralaštvo: teorijski i praktični prinos izvannastavnim glazbenim aktivnostima* [Musical creativity: theoretical and practical contribution to extracurricular musical activities]. Pula: Udruga za promicanje kvalitete i poticanje izvrsnosti u odgoju i obrazovanju „SEM“.
- Vidulin, S., & Plavšić, M. (2020). Contribution of cognitive-emotional approach to music listening on students' cognitive and emotional experience. *Musico logical Annual*, 56(1), 225-241. <https://doi.org/10.4312/mz.56.1.225-241>
- Vidulin, S., Plavšić, M. & Zauhar, V. (2019). *Usporedba spoznajnog i emocionalnog aspekta slušanja glazbe u glazbenopedagoškom kontekstu osnovne škole* [A comparison between the cognitive and emotional aspects of music listening

- in the context of primary school music teaching]. *Metodički ogledi: časopis za filozofiju odgoja*, 26(2), 9-32. <https://doi.org/10.21464/mo.26.2.4>
- Vidulin, S., Plavšić, M., & Žauhar, V. (2020). *Spoznajno-emocionalno slušanje glazbe u školi* [Cognitive-emotional listening to music in school]. Pula. Sveučilište Jurja Dobrile u Puli, Rijeka: Filozofski fakultet.
- Zachopoulou, E., Tsapakidou, A., & Derri, V. (2004). The effects of a developmentally appropriate music and movement program on motor performance. *Early Childhood Research Quarterly*, 19(4), 631-642. <http://dx.doi.org/10.1016/j.ecresq.2004.10.005>
- Zafranias, N. (2007). Piano keyboard training and the spatial-temporal development of young children attending kindergarten classes in Greece. *Early Child Development and Care*, 174(2), 199-211. <https://doi.org/10.1080/0300443032000153534>
- Yu, P. T., Lai, Y. S., Tsai, H. H., & Chang, Y. H. (2010). Using a multimodal learning system to support music instruction. *Journal of Educational Technology & Society*, 13(3), 151-162. Retrieved from <http://www.jstor.org/stable/jeductechsoci.13.3.151>



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The new health-care lexicon. (1983, August / September). *Copy Editor*, 4, 1-2.

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