

# Construct Validity of the Questionnaire Measuring Technical and Socio-psychological Factors which Affect Successful Integration of ICT into Education

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## Abstract

*A variety of measurement instruments which are used for researching different aspects of the use of ICT for educational purposes are available. However, construct validity of these instruments are often not checked and therefore their application is not always suitable. The aim of this research was to check the construct validity of the questionnaire used for measuring technical and socio-psychological factors affecting the frequency of ICT use among Croatian elementary school teachers in Zagreb (N=413) and the ways in which it is used. Questionnaire construct validity was proved by means of factor analysis which yielded four easily interpretable factors with a high degree of reliability.*

**Key words:** *education; elementary school teachers; ICT.*

## Introduction

ICT has become an integral part of all aspects of our lives. In the last twenty years the practice of the application of ICT has been fundamentally changed, along with the ways in which it affects the functioning of all human activities. Along with its application, the ICT has changed the way of teaching in schools. The way in which the ICT affects educational processes is obvious and this effect continues to increase. With the use of ICT, various new perspectives and possibilities have appeared within the educational process (Hutinski & Aurer, 2009). This is why it is necessary to check which factors affect the integration of ICT into education. In the available literature (Albirini, 2006;

Baylor & Ritchie, 2002; Isleem, 2003; Isman & Celikli, 2009; Palak & Wallers, 2009; Sam, Otham, & Nordim, 2005; Sang, 2010; ShanFu, 2013; Usluel, 2007; Wilson & Notar, 2003; Yilidirim, 2007; Yildirim, 2000; Yildirim & Kiraz, 1999) two kinds of factors which affect the use of ICT in education were noticed: technical and socio-psychological.

Technical aspects which affect the use of ICT in education are: availability of computers in schools, the availability of various computer programs in schools, adequate technical support and infrastructure for ICT use in education and various school activities, adequate instructional support, adequate training with regard to the use of ICT in education, etc. The more available the ICT and the better the technical support is, the more effective ICT integration into education is (ShanFu, 2013). A research study conducted by Yildirim in 2007 aimed at determining the aspects which teachers consider as obstacles to the successful integration of ICT into education. Among various factors, the emphasis was put on the technical ones: inadequate education and unavailability of computers in classrooms. Many other research studies show that the teachers require adequate, timely and continuous education with regard to the use of ICT in order to successfully integrate ICT into education (Northrup & Little, 1999, according to: Yildirim 2007; Wilson & Notar, 2003; Yildirim, 2000; Yildirim & Kiraz, 1999). Baranović, Batarelo and Barišić (2005) conducted a research study among 1<sup>st</sup>-4<sup>th</sup> grade (elementary school) teachers in Croatia and came to the conclusion that ICT is rarely used in teaching and that it is necessary to improve education with the use of ICT in such a way as to make it more effective. The results of a research study conducted in Zagreb in 2004 by the Institute for social research has shown that the teachers themselves evaluated their IT skills as insufficient which is, according to their evaluation, the result of an inadequate contribution of their initial university education, as well as their professional education so far (according to Bakić-Tomić & Dumančić, 2012). Thus the majority of teachers in Croatia consider e-education as useful but up to 70% of teachers who took part in the study do not consider themselves appropriately qualified for such activities (Oreški & Savić, 2013). The results of the research study conducted by Yilidirim (2007) show that teachers agree that the use of ICT is useful only if every classroom is equipped with the necessary number of computers; otherwise the use of ICT in education is a pointless loss of time and contributes to the development of negative attitudes toward the use of ICT. Other research studies also show that the lack of technical and financial support (on which the technical support depends) hinders successful integration of ICT into education (Liu & Szabo, 2009).

The socio-psychological factors affecting the use of ICT in education are: teachers' attitudes, teachers' self-confidence and school climate. Attitudes play an important role in determining human reaction in a specific situation. Allport's attitude definition is believed to encompass a variety of factors, according to which an attitude is a permanent mental i.e. neural readiness acquired with regard to the experience which exerts directive or dynamic influence on the reaction of an individual to objects and situations (Supek, 1968). In accordance with Allport's attitude components (Supek,

1968), the attitudes of teachers toward the use of ICT in education would encompass: an affective component which includes positive or negative emotional attitudes toward ICT, a behavioural component which refers to the intentions and readiness to use ICT in education, and cognitive components which refer to objective knowledge and subjective attitudes toward ICT. Various studies confirmed that teachers' attitudes strongly affect the ICT integration into education (Albirini, 2006; Baylor & Ritchie, 2002; Isleem, 2003; Palak & Wallers, 2009; Sang, 2010). Their attitudes have a direct or an indirect influence on the use of ICT for educational purposes (Player-Koro, 2012) and in case they are positive, this results in a greater feeling of effectiveness among teachers (Papasterigiou 2010, as cited in Player-Koro, 2012). Another very important socio-psychological factor is the self-confidence of teachers with regard to the ICT use in education. In accordance with Bandura's concept of self-efficacy (1997) the teachers' self-confidence related to the use of ICT in education refers to how teachers evaluate the probability of success with the use of ICT for educational purposes and in which measure they consider success as being under their control.

A group of Portuguese teachers who took part in the research study conducted by Peralta and Costa (2007) claim that self-confidence grows when teachers are not afraid of damaging the ICT equipment, when they are not afraid of making a mistake while using it and if they feel they are in control of the computer. Other studies also confirmed significant correlations between self-confidence and ICT use (Isman & Celikli, 2009; Sam, Otham & Nordim, 2005; Usluel, 2007). School climate is the third socio-psychological factor which affects the ICT use in education. Although there are a number of definitions of school climate, it can be said that the majority agrees that school climate is a multidimensional, relatively permanent perception phenomenon based on experience which is common to all employees of a certain school (Koys & Decotiis, 1991, as cited in Baranović, Domović, & Štribić, 2006). Depending on interests, values and motivation and other personality characteristics, school climate can be perceived as beneficial to individual development and can contribute to constructive behaviour and inclusion of an individual into the school activities or alternatively, as having a less stimulating effect which contributes to passivity and resistance exertion (Bošnjak, 1997). Hence school climate affects the behaviour, attitudes and beliefs of employees and therefore also affects their attitudes, behaviour and beliefs with regard to the use of ICT in education. The more positive the school climate is, the more the level of ICT use in education grows (Tezci, 2011, as cited in Shan 2013). Pelgrum and Law (2009) concluded that a successful integration of ICT into education depends more on the perception and vision of school principals than on teachers' competence with regard to ICT use. Various other studies (Kennewel, Parkinson & Tanner, 2000; McCormick, 1992; Ridgeway & Passey, 1995) have also confirmed the connection between school climate and ICT use in education.

The aim of this research study was to check the construct validity of the instrument used to determine teachers' attitudes, their self-confidence and certain aspects of school climate and technical support in school which affect the integration of ICT into

education. Construct validity of the instrument has been determined on the sample which consisted of Croatian teachers employed in 18 elementary schools in Zagreb during the school year 2012/2013.

## **Method**

### **Sample**

The research sample consisted of 413 teachers employed in 18 elementary schools in Zagreb, out of which there were 91.3% women and 8.7% men. 47% teach in lower grades (1<sup>st</sup> to 4<sup>th</sup> grade), 43.1% teach in higher grades (5<sup>th</sup> to 8<sup>th</sup> grade) whereas there were 9.9% who teach in both lower and higher grades. The average teachers' age in the sample was 40.6, ranging from 24 to 65. The tested teachers had an average of 14.9 years experience in teaching, ranging from less than one year (only 2.7%) to 45 years. With regard to the computer equipment and teachers' education in the field of informatics it was shown that 98.5% of teachers owned a private computer and that 82.1% had attended courses with the aim of professional education. With regard to the schools themselves they received computers on average 9.4 years ago. On average every school had 1.9 rooms with more than 5 computers. Teachers claimed on average that there were 1.3 computers in the classrooms they used for teaching.

### **Instrument**

In 2008 E. Papanastasiou and C. Angeli composed a questionnaire the aim of which was to determine which factors obstruct the integration of ICT into education and which seem to improve it. The questionnaire consists of 3 sub-scales: 1) Teachers' attitudes toward ICT integration into education (how do teachers feel while using ICT and whether they think that ICT is a useful/useless tool in educational practice), 2) Self-confidence of teachers connected with the ICT use in education (teachers' own subjective assessment of their knowledge of specific computer programs), 3) School climate and technical support (impact of other school staff on the use of ICT and the adequacy of the technical requirements in school). Papanastasiou and Angeli (2008) performed component factor analyses and got six final factors (Confidence in using ICT, Encouragement from colleagues, Anxiety, Beliefs about the value of the computer, Technology infrastructure, The computer as an agent of change) that explained 55.83% of the variance. The reliability of the five factors was high (Cronbach  $\alpha \geq 0.70$ ) but the factor determining the computer as an agent of change was of low reliability and was found to be 0.59. The questionnaire was adapted to the Croatian education system and was translated into Croatian. In the questionnaire used to check the attitudes and self-confidence of teachers as well as school climate and technical support aspects a Likert-type scale was used with the possible answers ranging from 1-completely disagree to 5-completely agree.

### **Data Analysis**

For the purpose of this research the data were analysed using the statistics program SPSS 17. Basic descriptive statistics was used (arithmetic mean, standard deviation)

for all variables in the questionnaire. Then, the factor analysis (Principal Axis factoring as a method for factor extraction) with orthogonal (varimax) rotation was performed. In order to determine the most adequate factor we used: the percentage of variance explained (Kaiser-Guttman criterion, i.e. keeping all those factors which have eigenvalues greater than one), scree plot, the number of values which saturate a factor (minimum 3), the overall variance explained (around 50%), whereas for the minimal saturation of specific factors the correlation of 0.30 was set. However, for the final solution attention was paid to satisfying the criteria of the interpretability of the factors. The reliability of the factors was expressed in terms of internal consistency (using the Cronbach's  $\alpha$  coefficient). Once we completed our final factor solution, we used the regression factor scores method in order to define the results in each factor. The correlations were calculated using Pearson's correlation coefficient.

## Results

### *Items Characteristics*

Descriptive statistics was first used for all variables in the questionnaire. Likert-type scale was used for all the items in the questionnaire and therefore, the results could be distributed on the scale of 1 to 5. Thus the average scores on specific items were from 1.58 to 4.49.

Table 1

*Descriptive analysis of teachers' attitudes toward ICT use in education*

	M	SD
I feel comfortable with the idea of the computer as a tool in teaching and learning.	4.34	0.88
The use of computers in teaching and learning stresses me out.	1.82	1.09
If something goes wrong, I will not know how to fix it.	2.52	1.30
The idea of using a computer in teaching and learning makes me sceptical.	1.74	1.07
The use of the computer as a learning tool excites me.	3.90	1.06
The use of computers in teaching and learning scares me.	1.58	0.97
The computer is a valuable tool for teachers.	4.49	0.80
The computer will change the way I teach.	3.75	1.14
The computer will change the way students learn in my classes.	3.68	1.13
The computer is not conducive to student learning because it is not easy to use.	2.19	1.24
The computer allows students to understand various abstract notions more effectively.	4.09	0.88
The computer helps students learn because it allows them to express their thinking in better and different ways.	3.15	1.17
The computer helps students understand concepts in more effective ways	3.90	1.16
The computer helps teachers to teach in more effective ways.	3.91	1.03
The computer is not conducive to good teaching because it creates technical problems.	2.08	1.10

Table 1 shows the descriptive analysis of the teachers' attitudes toward ICT use. According to the outlined results, teachers agree most with the following items: *I*

feel comfortable with the idea of the computer as a tool in teaching and learning, The computer is a valuable tool for teachers, The computer helps students understand concepts in more effective ways, whereas they disagree most with the following items: The use of computers in teaching and learning stresses me out, The idea of using a computer in teaching and learning makes me sceptical, The use of computers in teaching and learning scares me.

Table 2 shows descriptive analysis of teachers' self-confidence with regard to ICT use in education, according to which the majority of teachers stated they were most confident in their abilities while using Power point, e-mail and the Internet, whereas they are least confident when teaching their pupils how to create their own web pages.

Table 2

*Descriptive analysis of teachers' self-confidence with regard to ICT use in education*

	M	SD
I can select appropriate software to use in my teaching.	3.64	1.25
I can use PowerPoint in my class.	4.04	1.23
I can design technology-enhanced learning activities for my students.	2.78	1.26
I can use e-mail to communicate with my students.	3.89	1.36
I can teach my students to select appropriate software to use in their projects.	3.03	1.32
I can teach my students how to make their own web pages.	1.90	1.19
I can use the Internet in my lessons to meet certain educational goals.	3.81	1.28

Table 3 shows descriptive analysis of the evaluation of school climate and technical support in schools, according to which the majority of teachers agree with the following statements: *The principal encourages me to integrate computers into teaching and learning, Teachers in my school are well informed about the value of computers in teaching and learning*, whereas for the majority of other items the arithmetic mean is around 3 which means that on average the teachers neither agree nor disagree with the rest of the statements.

Table 3

*Descriptive analysis of the school climate and technical support in school*

	M	SD
Other teachers encourage me to integrate computers into teaching and learning.	3.26	1.22
The ICT coordinator encourages me to integrate computers into teaching and learning.	3.02	1.32
The principal encourages me to integrate computers into teaching and learning.	3.64	1.22
I often exchange ideas about technology integration with other teachers.	3.06	1.25
There are other teachers in my school who use computers in teaching and learning.	3.81	0.99
Teachers in my school are well informed about the value of computers in teaching and learning.	3.72	0.99
A variety of computer software is available for use in my school.	3.39	1.25
The technical support in my school is adequate.	3.31	1.26
The instructional support in my school is adequate.	3.13	1.24
The technical infrastructure in my school is adequate.	3.18	1.26

## Construct Validity

Factor analysis was performed to check the construct validity of the questionnaire. In order to run the factor analysis, it was necessary to test the sample adequacy and run a sphericity test in order to determine the adequacy of the data matrix. We used the Kaiser-Meyer-Olkin (KMO) measurement in order to test the sample adequacy. The KMO value was 0.90 and given that it is greater than 0.50, it showed that it was justified to run the factor analysis (Table 4). Bartlett's sphericity test was statistically significant ( $p < 0.001$ ), which means that the correlation matrix was not equivalent to the identity matrix, which further proves the adequacy of the data matrix (Table 4).

Factor analysis was performed on the following items: *Attitudes toward the use of computers, Teachers' self-confidence with regard to ICT use in education, School climate and technical support for the ICT use*. Three scales consisted on the whole of 32 Likert-type items. The second factor iteration resulted in four factors which on the whole explain 49.48% of variance of the three scales. Table 4 shows the saturation of specific items (*teachers' attitudes, teachers' self-confidence, school climate and technical support for the ICT use*) with the following factors: *Support in ICT use in education (technical and by colleagues), Emotional attitude of teachers toward ICT, Computer as an agent of change in the educational process, Teachers' self-confidence with regard to ICT use*.

The factor *Support in ICT use in education (technical and by colleagues)* explains 14.65% of variance and consists of 10 items: *The technical support in my school is adequate, A variety of computer software is available for use in my school, The technical infrastructure in my school is adequate, The instructional support in my school is adequate, The principal encourages me to integrate computers into teaching and learning, The ICT coordinator encourages me to integrate computers into teaching and learning, Teachers in my school are well informed about the value of computers in teaching and learning, Other teachers encourage me to integrate computers into teaching and learning, there are other teachers in my school who use computers in teaching and learning, I often exchange ideas about technology integration with other teachers*.

The *emotional attitude of teachers toward ICT* explains 14.36% of variance and consists of 8 items: *The use of computers in teaching and learning stresses me out, The use of computers in teaching and learning scares me, The idea of using a computer in teaching and learning makes me sceptical, The computer is not conducive to good teaching because it creates technical problems, The computer is not conducive to student learning because it is not easy to use, If something goes wrong, I will not know how to fix it, I feel comfortable with the idea of the computer as a tool in teaching and learning, The use of the computer as a learning tool excites me*.

The factor *Computer as an agent of change in the educational process* explains 10.82% of variance and consists of 7 items: *The computer will change the way students learn in my classes, The computer will change the way I teach, The computer helps teachers to teach in more effective ways, The computer allows students to understand various abstract notions more effectively, The computer helps students learn because it allows them to*



express their thinking in better and different ways, The computer helps students understand concepts in more effective ways, The computer is a valuable tool for teachers.

The factor *teachers' self-confidence with regard to ICT use* explains 9.65% of variance and consists of 7 items: *I can teach my students to select appropriate software to use in their projects, I can teach my students how to make their own web pages, I can design technology-enhanced learning activities for my students, I can select appropriate software to use in my teaching, I can use e-mail to communicate with my students, I can use PowerPoint in my class, I can use the Internet in my lessons to meet certain educational goals.*

Table 4 shows eigenvalues of the extracted main components. The eigenvalue of the first factor, *Support in the use of ICT (technical and by colleagues)* was 4.69, of the second factor *Emotional attitude of teachers toward ICT* 4.59, of the third factor *Computer as an agent of change in the educational process* 3.46, whereas that of the fourth factor *Teachers' self-confidence with regard to ICT use* was 3.09.

Table 4 also shows the value of Cronbach's  $\alpha$  coefficient for each factor. The value of Cronbach's  $\alpha$  for the factor *Support in the use of ICT (technical and by colleagues)* was 0.87, for the factor *Emotional attitude of teachers toward ICT* 0.86, for the factor *Computer as an agent of change in the educational process* it was 0.84 whereas for the factor *Teachers' self-confidence with regard to ICT use* it was 0.83. In case the reliability coefficient (Cronbach  $\alpha$ ) reaches a value around 0.80 or more, the reliability can be considered as very good (Kline, 1998). Therefore, it can be said that all the aforementioned factors show a high level of reliability.

Table 4

*Component structure and reliability of the questionnaire: attitudes toward computer use, teachers' self-confidence with regard to ICT use in education, school climate and technical support in using ICT in education*

	Support in the use of ICT (technical and by colleagues)	Emotional attitude of teachers toward ICT	Computer as an agent of change in the educational process	Teachers' self-confidence with regard to ICT use	Initial	Extraction
The technical support in my school is adequate.	0.760				0.61	0.61
The technical infrastructure in my school is adequate.	0.760				0.59	0.65
A variety of computer software is available for use in my school.	0.755				0.51	0.47
The instructional support in my school is adequate.	0.747				0.45	0.43
The principal encourages me to integrate computers into teaching and learning.	0.707				0.39	0.38
The ICT coordinator encourages me to integrate computers into teaching and learning.	0.669				0.56	0.59



	Support in the use of ICT (technical and by colleagues)	Emotional attitude of teachers toward ICT	Computer as an agent of change in the educational process	Teachers' self-confidence with regard to ICT use	Initial	Extraction
Other teachers encourage me to integrate computers into teaching and learning.	0.643				0.46	0.42
Teachers in my school are well informed about the value of computers in teaching and learning.	0.622				0.71	0.56
There are other teachers in my school who use computers in teaching and learning.	0.600				0.7	0.58
I often exchange ideas about technology integration with other teachers.	0.413				0.46	0.47
The use of computers in teaching and learning stresses me out.		0.78			0.41	0.39
The use of computers in teaching and learning scares me.		0.725			0.42	0.32
The computer is not conducive to good teaching because it creates technical problems.		0.64			0.51	0.46
If something goes wrong, I will not know how to fix it.		0.635			0.49	0.46
The computer is not conducive to student learning because it is not easy to use.		0.631			0.64	0.6
The idea of using a computer in teaching and learning makes me sceptical.		0.629			0.64	0.58
I feel comfortable with the idea of the computer as a tool in teaching and learning.		0.609	0.404		0.59	0.61
The use of the computer as a learning tool excites me.		0.467	0.393		0.46	0.35
The computer will change the way students learn in my classes.			0.756		0.6	0.65
The computer will change the way I teach.			0.737		0.46	0.44
The computer helps teachers to teach in more effective ways.			0.632		0.57	0.51
The computer allows students to understand various abstract notions more effectively.			0.592		0.52	0.5
The computer helps students understand concepts in more effective ways.			0.547	0.369	0.56	0.43
The computer is a valuable tool for teachers.		0.381	0.515		0.54	0.48

	Support in the use of ICT (technical and by colleagues)	Emotional attitude of teachers toward ICT	Computer as an agent of change in the educational process	Teachers' self-confidence with regard to ICT use	Initial	Extraction
The computer helps students learn because it allows them to express their thinking in better and different ways.			0.508		0.57	0.54
I can teach my students to select appropriate software to use in their projects.				0.743	0.36	0.26
I can design technology-enhanced learning activities for my students.		0.321		0.684	0.47	0.37
I can teach my students how to make their own web pages.				0.633	0.48	0.39
I can select appropriate software to use in my teaching.		0.47		0.566	0.61	0.58
I can use PowerPoint in my class.		0.51		0.521	0.72	0.59
I can use the Internet in my lessons to meet certain educational goals.		0.432		0.488	0.6	0.57
I can use e-mail to communicate with my students.		0.306		0.476	0.71	0.6
Reliability (Cronbach $\alpha$ )	0.87	0.86	0.84	0.88		
Eigenvalue	4.69	4.59	3.46	3.09		
Variance explained(%)	14.65	14.36	10.82	9.65		
KMO measure of sample adequacy	0.90					
Bartlett's sphericity test	6593.09	p<0.001				

**Correlations between factors provided by the factor analysis of the following sub-scales: Familiarity with specific computer programs, Frequency of use of specific computer programs, Teachers' attitudes toward the integration of ICT into education, Self-confidence of teachers with regard to ICT use, School climate and technical support**

This research study was part of a much larger project which aimed at researching familiarity with and the frequency of use of specific computer programs among elementary school teachers in Zagreb. Two different questionnaires had already been applied to the same sample and factor analysis had been performed (Tomić, 2014). The factor analysis of the first questionnaire referred to the teachers' self-evaluation of their familiarity with different computer programs and two factors had been extracted: *Familiarity with specialised computer programs* and *Familiarity with common computer programs* (which on the whole explain 62.96% of variance) (Tomić, 2014). The factor analysis of the other questionnaire referred to the frequency of use of specific computer programs and again two factors had been extracted: *Use of specialised computer programs* and *Use of common computer programs* (which on the whole explain 52.13% of variance) (Tomić, 2014).

Table 5 shows the correlations between the aforementioned four factors provided by the application of the two questionnaires (Tomić, 2014) and four factors which were the result of the factor analyses done on the following items of the questionnaire: *Attitudes toward computer use, Teachers' self-confidence with regard to ICT use, School climate and technical support in schools*. The correlation between two factors *Support in the use of ICT (technical and by colleagues)* and *Use of specialised computer programs* is statistically significant, positive but low ( $r=0.105$ ). The correlation between the factors *Emotional attitude of teachers toward ICT* and *Familiarity with common computer programs* is statistically significant, positive and moderate ( $r=0.557$ ). The factor *Emotional attitude of teachers toward ICT* is also statistically significantly, positively and moderately correlated to the factor *Use of common computer programs* ( $r=-0.524$ ), whereas the correlation between the factor *Emotional attitude of teachers toward ICT* and factors *Familiarity with specialised computer programs* ( $r=-0.099$ ) and *Use of specialised computer programs* ( $r=-0.118$ ) is statistically significant, negative and low. The correlations between the factor *Computer as an agent of change in the educational process* and *Familiarity with common computer programs* ( $r=0.168$ ) and *Use of common computer programs* ( $r=0.202$ ) is statistically significant, positive and very low. The correlations between factors *Teachers' self-confidence with regard to ICT use* and *Familiarity with specialised computer programs* ( $r=0.486$ ), *Familiarity with common computer programs* ( $r=0.462$ ), *Use of specialised computer programs* ( $r=0.347$ ) and *Use of common computer programs* ( $r=0.422$ ) are statistically significant, positive and low to moderate. The correlations between the factors revealed in this study (*Support in the use of ICT, Emotional attitude of teachers toward ICT, Computer as an agent of change in the educational process, Teachers' self-confidence with regard to ICT use*) are close to zero, as a direct consequence of the method for defining factor scores.

Table 5

*Correlations between the 8 factors of the sub-scales: Familiarity with certain computer programs, Frequency of use of specific computer programs, Teachers' attitudes toward the integration of ICT into education, Teacher's self-confidence with regard to ICT use, School climate and technical support*

	Familiarity with specialised computer programs	Familiarity with common computer programs	Use of specialised computer programs	Use of common computer programs
Support in the use of ICT (technical and by colleagues)	0.097	0.016	0.105*	0.022
Emotional attitude of teachers toward ICT	-0.099*	0.557**	-0.118*	0.524**
Computer as an agent of change in the educational process	0.020	0.168**	0.007	0.202**
Teachers' self-confidence with regard to ICT use	0.486**	0.462**	0.347**	0.422**

\* statistically significant correlation with 5% risk

\*\*statistically significant correlation with 1% risk

## Discussion and Conclusion

The questionnaire we used aimed to encompass as many different factors which affect the use of ICT in education as possible because the majority of instruments used to research ICT integration into education do not encompass all the aspects of this field and only a few of the aforementioned factors are included in them (Papanastasiou & Angeli, 2008). Metrical characteristics of such instruments are not always precisely defined and therefore the suitability of their application is questionable. The instrument used in this research is more thorough and has been composed with the purpose of collecting data on different aspects of ICT integration into education, which can be considered as the biggest advantage of this research study.

Research results show that teachers mostly have positive attitudes with regard to ICT use in education, that they believe that the computer is an efficient tool in education and that both teachers as well as pupils can benefit from using it. The teachers mostly do not experience cyber phobia, i.e. fear of computers, and as regards their self-confidence, it is high when it comes to using common computer programs (e.g. Power Point) but it drops with regard to specialised computer programs use (e.g. programs used to create web pages). As low but negative correlations show, the emotional attitude of teachers toward ICT mostly has a negative connotation (fear of computers) when it comes to using specialised computer programs. Given that the self-confidence of teachers is directly influenced by the availability of computers, technical and instructional support (Jamieson-Proctor et al., 2006), future studies should research in depth the adequacy of ICT equipment and computer programs which are available in schools. The majority of teachers positively evaluated school climate aspects which are connected to the integration of ICT into education.

In order to determine the construct validity of the questionnaire, factor analysis was run which resulted in four factors which are easy to interpret and are highly reliable: *Support in the use of ICT (technical and by colleagues)*, *Emotional attitude of teachers toward ICT*, *Computer as an agent of change in the educational process* and *Teachers' self-confidence with regard to ICT use*. Papanastasiou and Angeli (2008) obtained six final factors (*Confidence in using ICT*, *Encouragement from colleagues*, *Anxiety*, *Beliefs about the value of the computer*, *Technology infrastructure*, *The computer as an agent of change*) and it can be noted that their factors are very similar to the factors in this research. Also, in this research some of their factors "are merged" together as one (*Encouragement from colleagues* and *Technology infrastructure* as a *Support in the use of ICT (technical and by colleagues)*). In comparison with Papanastasiou and Angeli (2008) the results of this research show a clearer factor structure and all factors are highly reliable.

The feelings of comfort/discomfort when it comes to using computers as well as the teachers' self-confidence are significantly (and more than other factors) connected with the familiarity and frequency of the use of common and specialised computer

programs, from which it follows that the application of ICT in education is more connected to inner aspects and less with aspects such as technical support and the support of colleagues.

The drawback of this research is that there is a possibility that the subjects gave socially acceptable answers, which is why it would be useful to retest in order to additionally check the questionnaire's reliability. It is also necessary to take into consideration that the teachers' evaluations with regard to their ICT competence are subjective and that they do not need to match the opinion of an outside observer. Therefore, it would be beneficial to run a cross-validation in order to determine the points in which the teachers' evaluation of their competences and those of an outside observer match. Finally, it would be beneficial to improve the predictive validity of the questionnaire using objective measures of computer competences in the questionnaire. Additional information could be collected by means of the stratification of the sample with regard to gender, age groups and work experience.

## References

- Albirini, A. A. (2006). Teachers' attitudes toward information and communication technologies: the case of Syrian EFL teachers. *Journal of Computers and Education*, 47, 373-398. doi: 10.1016/j.compedu.2004.10.
- Bakić-Tomić, Lj., & Dumančić, M. (2012). *Odabrana poglavlja iz metodike nastave informatike*. Zagreb: Učiteljski fakultet u Zagrebu.
- Bandura, A. (1997). *Self-efficacy: the exercise of control*. New York: Freeman.
- Baranović, B., Batarel, I., & Marušić, I. (2005). Information and communication technology use in Croatian schools: Focus on teachers and school principals. In C.P. Constantinou et al. (Eds.), *Conference Proceedings "Integrating Multiple Perspectives on Effective Learning Environments"* (pp. 100-115). Nicosia: University of Cyprus.
- Baranović, B., Domović, V., & Štrubić, M. (2007). Obrazovanje za poduzetnost – perspektiva osnovnoškolskih učitelja i nastavnika. *Sociologija i prostor*, 45(3-4), 339-360.
- Baylor, A., & Ritchie, D. (2002). What factors facilitate teacher skill, teacher morale, and perceived student learning in technology-using classrooms? *Journal of Computers & Education*, 39(1), 395-414. [http://dx.doi.org/10.1016/S0360-1315\(02\)00075-1](http://dx.doi.org/10.1016/S0360-1315(02)00075-1)
- Bošnjak, B. (1997). *Drugo lice škole: Istraživanje razredno-nastavnog ozračja*. Zagreb: Alinea.
- Hutinski, Ž., & Aurer, B. I. (2009). Informacijska i komunikacijska tehnologija u obrazovanju: stanje i perspektive. *Informatologija*, 42(4), 265-272.
- Isleem, M. (2003). *Relationships of selected factors and the level of computer use for instructional purposes by technology education teachers in Ohio public schools: a state wide survey*. Doctoral dissertation, Ohio State University.

- Isman, A. & Celikli, G. E. (2009). How does student ability and self-efficacy affect the usage of computer technology? *The Turkish Online Journal of Educational Technology*, 8(1), 33-38.
- Jamieson-Proctor, R. M., Burnett, C. C., Finger, G., & Watson, G. (2006). ICT integration and teachers confidence in using ICT for teaching and learning in Queensland state schools. *Australasian Journal of Educational Technology*, 11(4), 511-530.
- Kennewell, S., Parkinson, J. & Tanner, H. (2000). *Developing the ICT Capable School*. London: Routledge/Falmer.
- Kline, R. B. (1998). *Principles and Practise of structural Equation Modelling*. New York: Guilford Press. <http://dx.doi.org/10.1080/10705511.2012.687667>
- Liu, Y., & Szabo, Z. (2009). Teachers' attitudes toward technology integration in schools. *Teachers and Teaching: Theory and Practice*, 15(1), 5-23. London: Routledge Falmer. <http://dx.doi.org/10.1080/13540600802661295>
- McCormick, R. (1992). Curriculum development and technology. *Information Technology for Teacher Education*, 1, 23-50.
- Oreški, P., & Savić, I. (2013). Primary Education Teachers E-Learning Adoption. In Mokryš, M., Badura, Š., & Lieskovsky, A. (Eds.), *Conference Proceedings, "The 1st Human And Social Sciences at the Common Conference"* (pp. 228-231). Žilina: University of Žilina.
- Palak, D., & Walls, R. T. (2009). Teachers' beliefs and technology practices: A mixed-methods approach. *Journal of Research on Technology in Education*, 41, 157-181. <http://dx.doi.org/10.1080/15391523.2009.10782537>
- Papanastasiou E. C., & Angeli, C. (2008). Evaluating the Use of ICT in Education: Psychometric Properties of the Survey of Factors Affecting Teachers Teaching with Technology (SFA-T3). *Educational Technology and Society*, 11(1), 69-86.
- Pelgrum, W. J., & Law, N. (2009). *ICT in Education around the world: Trends, problems and prospects*, *Unesco: International Institute for Educational Planning Publication*. UN: Paris.
- Peralta, H., & Costa, F.A. (2007). Teachers' competence and confidence regarding the use of ICT. *Educational Sciences Journal*, 3, 75-84.
- Player-Coro, C. (2012). Factors influencing Teacher's use of ICT in education. *Education Inquiry*, 3(1), 93-108. <http://dx.doi.org/10.3402/edui.v3i1.22015>
- Ridgeway, J., & Passey, D. (1995). Using evidence about teacher development to plan systemic revolution. In D. M. Watson & D. Tinsley (Eds.), *Integrating Information Technology into Education* (pp. 59-72). US: Springer. <http://dx.doi.org/10.1007/978-0-387-34842-1>
- Sam, H. K., Othman, A. E. A., & Nordin, Z. S. (2005). Computer Self-Efficacy, Computer Anxiety, and Attitudes toward the Internet: A Study among Undergraduates in Unimas. *Educational Technology & Society*, 8(4), 205-219.
- Sang, G., Valcke, M., Braak, J., & Tondeur, J. (2010). Student teachers' thinking processes and ICT integration: Predictors of prospective teaching behaviors with educational technology. *Computer and Education*, 54, 103-112. <http://dx.doi.org/10.1016/j.compedu.2009.07.010>
- ShanFu, J. (2013). ICT in Education: A Critical Literature Review and Its Implications. *International Journal of Education and Development using Information and Communication Technology*, 9(1), 112-125.
- Supek, R. (1968). *Ispitivanje javnog mnijenja*. Zagreb: Naprijed.

- Tomić, M. K. (2014). Competence and motivation of compulsory education teachers in the Republic of Croatia for the application of ICT in their work. In M. Orel & S. Jurjevčič (Eds.), *Conference Proceedings, "InfoKomTeh 2014: New vision of Future Technologies"* (pp. 107-119). Polhov Gradec: Eduvision.
- Usluel, Y. K. (2007). Can ICT usage make a difference on student teachers' information literacy self-efficacy. *Library and Information Science Research*, 29, 92-102. <http://dx.doi.org/10.1016/j.lisr.2007.01.003>
- Wilson, J., & Notar, C. (2003). Use of computers by secondary teachers: a report from a university service area. *Education*, 123(4), 495-704.
- Yildirim, S. (2000). Effects of an educational computing course on preservice and inservice teachers: A discussion and analysis of attitudes and use. *Journal of Research on Computing in Education*, 32(4), 479-495. <http://dx.doi.org/10.1080/08886504.2000.10782293>
- Yildirim, S. (2007). Current utilization of ICT in Turkish basic education schools: a review of teacher's ICT use and barriers to integration. *International Journal of Instructional Media*, 34(2), 171-186.
- Yıldırım, S., & Kiraz, E. (1999). Obstacles in Integrating Online Communication Tools into Preservice Teacher Education: A Case Study. *Journal of Computing in Teacher Education*, 15, 23-25.

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# Konstruktna valjanost upitnika kojim se ispituju tehnički i socio-psihološki čimbenici koji utječu na uspješnu integraciju informacijsko-komunikacijske tehnologije (ICT-a) u nastavu

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## Sažetak

*Postoji niz mjernih instrumenata kojima se ispituju različiti aspekti korištenja informacijsko-komunikacijskom tehnologijom u edukativne svrhe. Međutim, konstruktna valjanost tih instrumenata često se ne provjerava pa njihova primjena nije uvijek prikladna. Cilj ovoga istraživanja jest provjeriti konstruktnu valjanost upitnika kojim se ispituju tehnički i socio-psihološki čimbenici koji utječu na načine i učestalost korištenja ICT-om u nastavi na uzorku hrvatskih učitelja u osnovnim školama u gradu Zagrebu (N=413). Konstruktna valjanost instrumenta dokazana je na temelju faktorske analize koja je rezultirala s četiri faktora visoke pouzdanosti koje je lako interpretirati.*

**Ključne riječi:** ICT; nastava; učitelji osnovnih škola.

## Uvod

Informacijsko-komunikacijske tehnologije postale su sastavni dio svih aspekata života. Tako je u posljednjih dvadesetak godina primjena ICT-a u osnovi promijenila praksu i načine poslovanja u svim ljudskim djelatnostima. U skladu s tim primjena ICT-a je promijenila i način poučavanja u školama. Utjecaj ICT-a na obrazovne procese u školama očit je i svakim danom postaje sve veći. Također, upotrebom ICT-a otvaraju se brojne nove perspektive i mogućnosti unutar obrazovnog procesa (Hutinski i Aurer, 2009). Stoga je nužno ispitati koji su to čimbenici koji utječu na uspješnu integraciju ICT-a u školsku nastavu. Uvidom u dostupnu literaturu (Albirini, 2006; Baylor i Ritchie, 2002; Isleem, 2003; Isman i Celikli, 2009; Palak i Wallers, 2009; Sam, Otham i Nordim, 2005; Sang, 2010; ShanFu, 2013; Usluel, 2007; Wilson i Notar, 2003; Yilidirim, 2007; Yildirim, 2000; Yildirim i Kiraz, 1999) primijećeno je kako postoje dvije vrste čimbenika koji utječu na korištenje ICT-om u nastavi: tehnički i socio-psihološki.

Tehnički čimbenici koji utječu na korištenje ICT-om u nastavi su: dostupnost računala u školi, dostupnost različitih računalnih programa u školi, primjerena tehnička podrška i infrastruktura za korištenje ICT-om u nastavi i školskim aktivnostima, primjerena instruktorska podrška, adekvatna obuka za korištenje ICT-om u nastavi itd. Što je informacijsko-komunikacijska tehnologija dostupnija i cjelokupna tehnička podrška bolja, veća je i učinkovitost učitelja u integraciji ICT-a u nastavu (ShanFu, 2013.). Studija Yildirima iz 2007. godine imala je za cilj odrediti koji su to čimbenici koje učitelji smatraju preprekama uspješnoj integraciji ICT-a u nastavu. Među brojnim čimbenicima isticali su se oni tehničke prirode: neadekvatna edukacija i nedostupnost računala u razredima. I mnogobrojna druga istraživanja pokazuju kako je nastavnicima nužno potrebna adekvatna, pravodobna i kontinuirana edukacija o korištenju ICT-om kako bi uspješno integrirali ICT u svoju nastavu (Northrup i Little, 1999 prema Yildirim 2007; Wilson i Notar, 2003; Yildirim, 2000; Yildirim i Kiraz, 1999). Baranović, Batarello i Barišić (2005) ispitivanjem predmetnih učitelja u osnovnim školama u Hrvatskoj dolaze do zaključaka kako se ICT u nastavi koristi rijetko i kako je nužno poboljšati obrazovanje povezano s upotrebom ICT-a u nastavi na način da bude učinkovitije. Također, rezultati istraživanja Instituta za društvena istraživanja u Zagrebu iz 2004. godine pokazuju kako su i sami učitelji procijenili da posjeduju nedovoljna informatička znanja, što je prema njihovim procjenama rezultat lošeg doprinosa inicijalnog fakultetskog obrazovanja, ali i dosadašnjeg organiziranog stručnog usavršavanja (Bakić-Tomić i Dumančić, 2012). U Hrvatskoj većina učitelja smatra e-obrazovanje korisnim, ali čak 70% učitelja obuhvaćenih istraživanjem smatra da nisu dovoljno educirani za takve aktivnosti (Oreški i Savić, 2013). Rezultati Yildirimova istraživanja (2007) pokazuju i to da se učitelji slažu kako je korištenje ICT-a učinkovito jedino ako je svaki razred opskrbljen potrebnim brojem računala, a u suprotnom slučaju upotreba ICT-a u nastavi je beskorisno trošenje vremena i doprinosi razvijanju negativnih stavova prema korištenju ICT-a. I druge studije pokazuju kako su nedostatak tehničke i financijske potpore (o kojoj ovisi tehnička potpora) barijere uspješnoj integraciji ICT-a u nastavu (Liu i Szabo, 2009).

Socio-psihološki faktori koji utječu na korištenje ICT-om u nastavi su: stavovi učitelja, samopouzdanje učitelja i školska klima. Stav ima važnu ulogu u određivanju ljudske reakcije u određenoj situaciji. Najcjelovitijom se smatra Allportova definicija stava koja kaže da je stav trajna mentalna, odnosno neuralna spremnost stečena na osnovi iskustva koja vrši direktivni ili dinamički utjecaj na reagiranje pojedinca na objekte i situacije (Supek, 1968). U skladu s Allportovim komponentama stava (Supek, 1968), stavovi nastavnika prema korištenju ICT-om u nastavi bi uključivali: afektivnu komponentu koja sadrži pozitivni ili negativni emocionalni odnos prema ICT-u, bihevioralnu komponentu koja se odnosi na namjere i spremnost na korištenje ICT-om u nastavi, kognitivnu komponentu koja se odnosi na objektivno znanje i subjektivna uvjerenja o ICT-u. Mnogobrojne studije potvrdile su kako stavovi učitelja snažno utječu na integraciju ICT-a u školsku nastavu (Albirini, 2006; Baylor i Ritchie, 2002;

Isleem, 2003; Palak i Wallers, 2009; Sang, 2010). Stavovi učitelja imaju direktan ili indirektan utjecaj na korištenje ICT-om u edukativne svrhe (Player-Koro, 2012), a ako su pozitivni, rezultiraju i većim osjećajem učinkovitosti kod učitelja (Papasterigiou 2010, prema Player-Koro, 2012). Drugi važan socio-psihološki faktor jest samopouzdanje učitelja u vezi s korištenjem ICT-em u nastavi. U skladu s Bandurinim konceptom o samoučinkovitosti (1997) samopouzdanje nastavnika povezano s korištenjem ICT-em u nastavi odnosi se na to kako nastavnici procjenjuju vjerojatnost uspjeha kod korištenja ICT-em u edukativne svrhe i na to u kolikoj mjeri smatraju da je takav uspjeh pod njihovom kontrolom. U studiji Peralta i Coste (2007) skupina portugalskih učitelja tvrdi da samopouzdanje raste ako učitelji nemaju strah od oštećenja informacijsko-komunikacijske tehnologije, ako nemaju strah od moguće pogreške kod korištenja informacijsko-komunikacijskom tehnologijom i ako osjećaju da vladaju računalom. I druge su studije potvrdile značajne korelacije između samopouzdanja i korištenja ICT-om (Isman i Celikli, 2009; Sam, Otham i Nordim, 2005; Usluel, 2007). Školska klima je treći socio-psihološki faktor koji utječe na korištenje ICT-om u nastavi. Iako postoje brojne definicije školske klime, može se reći da je većina njih suglasna u tome da je školska klima na iskustvu utemeljen, multidimenzionalan, relativno trajan percepcijski fenomen koji je zajednički članovima određene škole (Koys i Decotiis, 1991 prema Baranović, Domović i Štribić, 2006). Ovisno o interesima, vrijednostima, motiviranosti i ostalim karakteristikama pojedinca školska klima može biti percipirana kao poticajna za individualni razvoj i doprinosti konstruktivnom ponašanju i uključivanju pojedinca u aktivnosti škole ili pak suprotno, kao destimulirajući kontekst koji doprinosi pasivnosti, pružanju otpora i sl. (Bošnjak, 1997). Dakle, školska klima utječe na ponašanja, stavove i vjerovanja svojih zaposlenika pa tako i na njihove stavove, ponašanja i vjerovanja koja su povezana s korištenjem ICT-em u nastavi. Što je pozitivnija školska klima to je i frekvencija korištenja ICT-em u edukativne svrhe veća (Tezci, 2011 prema Shan 2013). Pelgrum i Law (2009) zaključili su kako uspješna integracija ICT-a u nastavu više ovisi o percepciji i vizijama školskih ravnatelja nego li o kompetencijama učitelja vezanim uz korištenje ICT-em. I razne druge studije (Kennewel, Parkinson, Tanner, 2000; McCormick, 1992; Ridgeway i Passey, 1995) potvrdile su povezanost školske klime i upotrebe ICT-a u nastavi.

Cilj rada je ispitati konstruktivnu valjanost mjernog instrumenta kojim se ispituju stavovi učitelja, samopouzdanje učitelja, određeni aspekti školske klime i tehničke potpore u školama koji utječu na (ne)uspješnu integraciju ICT-a u nastavu. Određuje se konstruktivna valjanost instrumenta na uzorku hrvatskih učitelja zaposlenih u 18 osnovnih škola u gradu Zagrebu u školskoj godini 2012/2013.

## **Metode**

### **Uzorak**

Uzorak ovog istraživanja uključuje ukupno 413 učitelja koji predaju u 18 osnovnih škola u Zagrebu. Od toga je 91,30% žena i 8,70% muškaraca. 47,00% je učitelja primarnog obrazovanja (koji predaju učenicima od 1. do 4. razreda osnovne škole),

43,10% je učitelja predmetne nastave (koji predaju učenicima od 5. do 8. razreda osnovne škole) i 9,90% učitelja istodobno zaposlenih u predmetnoj i razrednoj nastavi. Prosječna starost učitelja u uzorku je 40,65 godina s minimalnom starosnom dobi od 24 i maksimalnom starosnom dobi od 65 godina. Prosječno, učitelji u uzorku imaju 14,90 godina iskustva rada u nastavi, a maksimalan broj godina radnog iskustva iznosi 45. 2,70% učitelja u uzorku imaju manje od jedne godine radnog staža u školi. Vezano uz računalnu opremu i obrazovanje učitelja u području računarstva pokazalo se da 98,50% učitelja posjeduje računalo kod kuće te da ih je 82,10% pohađalo računalne tečajeve u svrhu profesionalnog usavršavanja. Što se tiče samih škola, u prosjeku su dobile računala prije 9,40 godine i u prosjeku svaka škola ima svega 1,90 prostorija s više od 5 računala. Učitelji su u prosjeku tvrdili da u učionici kojom se oni koriste u nastavi ima 1,30 računala.

### **Instrument**

E. Papanastasiou i C. Angeli konstruirale su 2008. godine upitnik čiji je cilj bio ustanoviti koji faktori ometaju integraciju ICT-a u nastavu, a koji je pospješuju. Upitnik je sastavljen od tri subskele: 1. Stavovi učitelja o integraciji ICT-a u nastavi (kako se učitelji osjećaju prilikom korištenja ICT i kako procjenjuju (ne)korisnost upotrebe ICT-a u nastavi) 2. Samopouzdanje učitelja povezano s korištenjem ICT-a u nastavi (subjektivna procjena učitelja o poznavanju različitih računalnih programa), 3. Školska klima i tehnička potpora u školi (utjecaj ostalih zaposlenika u školi na korištenje ICT-em u nastavi i adekvatnost tehničke opreme u školi). Komponentna faktorska analiza koju su proveli Papanastasiou i Angeli (2008) rezultirala je sa šest faktora (*Pouzdanje povezano s korištenjem ICT-em, Potpora kolega, Anksioznost povezana s korištenjem ICT-em, Uvjerenja o vrijednosti računala kao alata u nastavi, Tehnička infrastruktura, Računalo kao agent promjene u obrazovnom procesu*) koji ukupno objašnjavaju 55,83% varijance. Pet faktora ima visoku pouzdanost (Cronbach  $\alpha \geq 0,70$ ), a faktor Računalo kao agent promjene u obrazovnom procesu ima nisku pouzdanost (Cronbach  $\alpha = 0,59$ ). Upitnik je prilagođen hrvatskim prilikama u obrazovanju i preveden na hrvatski jezik. Na upitniku kojim su se ispitivali stavovi i samopouzdanje učitelja kao i aspekti školske klime i tehničke potpore u školama koji utječu na uspješnu integraciju ICT-a u nastavu korištena je Likertova skala od pet stupnjeva, a mogućnosti odgovora varirale su od *Uopće se ne slažem (s navedenom tvrdnjom)* do *U potpunosti se slažem (s navedenom tvrdnjom)*.

### **Analiza podataka**

Za potrebe istraživanja podatci su bili analizirani korištenjem statističkog programa SPSS 17.00. Koristila se temeljna deskriptivna statistika (aritmetičke sredine, standardna raspršenja) za sve varijable u upitniku, zatim je provedena faktorska analiza (Principal Axis) s ortogonalnom (varimax) rotacijom. U određivanju najpogodnijeg broja faktora koristila se: količina objašnjene varijance (Kaiser-Guttmanov kriterij:

zadržavanje svih onih faktora koji imaju vrijednost karakterističnog korijena veću od 1), dijagram odrona (Scree plot), broj varijabli koje saturiraju faktor (minimalno 3), ukupno objašnjena varijanca (oko 50%), a kao minimalna saturacija pojedine glavne komponente određena je korelacija od 0,30. Međutim, za finalnu soluciju posebno se vodilo računa o zadovoljavanju kriterija lake interpretabilnosti faktora. Mjera pouzdanosti tipa unutarnje dosljednosti skupa tvrdnji koje definiraju pojedini faktor provjerena je računanjem Cronbachova  $\alpha$  koeficijenta. Nakon dobivanja finalne faktorske solucije, metodom regresijskih faktorskih bodova definirani su rezultati pojedinca u pojedinim faktorima. Povezanosti između faktora izračunate su primjenom Pearsonova koeficijenta korelacije.

## Rezultati

### Osobine čestica

Najprije se koristila deskriptivna statistika za sve varijable u upitniku. Čestice u upitniku su čestice na Likertovim skalama pa su se rezultati mogli distribuirati u rasponu od 1 do 5. Tako je prosječan rezultat na pojedinim česticama u skali zauzeo vrijednost od 1,58 pa sve do 4,49.

U Tablici 1. prikazani su deskriptivni pokazatelji stavova učitelja o korištenju ICT-em u nastavi. Prema rezultatima prikazanim u Tablici 1. učitelji se najviše slažu sa sljedećim tvrdnjama: *Osjećam se ugodno pri pomisli na mogućnost korištenja računalom kao alatom u nastavi i učenju; Računalo je vrijedan alat za rad učitelja; Računalo omogućava učenicima učinkovitije upoznavanje s različitim apstraktnim pojmovima i konceptima*, a u najmanjoj se mjeri slažu sa sljedećim tvrdnjama: *Upotreba računala u nastavi i učenju kod mene izaziva napetost i stres; Skeptičan sam prema korištenju računalom u procesu učenja i poučavanja; Plaši me upotreba računala u nastavi i učenju.*

#### Tablica 1.

U Tablici 2 prikazani su deskriptivni pokazatelji osjećaja samopouzdanja (sigurnosti) kod učitelja u vezi s korištenjem ICT-a u nastavi prema kojima je najveći broj učitelja procijenio da su najsigurniji kada se koriste *Power Point*-om, zatim *e-mailom* i internetom, a najnesigurniji su kada trebaju podučiti učenike da kreiraju vlastite mrežne stranice.

#### Tablica 2.

U Tablici 3 prikazani su deskriptivni pokazatelji procjene školske klime i tehničke potpore u školama prema kojima se najveći broj učitelja uglavnom slaže s tvrdnjama: *I drugi se učitelji u mojoj školi koriste računalom u nastavi; Ravnatelj u mojoj školi potiče me na korištenje računalom u nastavi; Učitelji u mojoj školi dobro su informirani o važnosti računala za nastavu. Za većinu ostalih tvrdnji vrijednosti aritmetičkih sredina su oko 3, što znači da se s ostalim tvrdnjama učitelji u prosjeku niti slažu niti ne slažu.*

#### Tablica 3.

## **Konstruktna valjanost**

Kako bi se ustanovila konstruktna valjanost upitnika, provedena je faktorska analiza (Principal Axis). U provođenju faktorske analize ponajprije je bilo potrebno testirati adekvatnost uzorka i provesti test sferičnosti s ciljem određivanja pogodnosti matrice podataka za faktorizaciju. Kaiser-Meyer-Olkin (KMO) mjerom testirana je prikladnost uzorka. KMO vrijednost iznosi 0,90, a budući da je KMO vrijednost veća od 0,50, provođenje faktorske analize pokazalo se opravdanom (Tablica 4). Također, Bartlettov test sferičnosti statistički je značajan ( $p < 0,001$ ), što znači da korelacijska matrica nije jednaka matrici identiteta, što je dodatni dokaz pogodnosti matrice podataka za faktorizaciju (Tablica 4).

Faktorska analiza provedena je na česticama *Stavova o korištenju računalom, Samopouzdanju učitelja vezanom uz korištenje ICT-em u nastavi, Školskoj klimi i tehničkoj potpori korištenju ICT-em u nastavi*. Tri skale ukupno su imale 33 čestice Likertova tipa. Druga faktorska iteracija rezultirala je s četiri faktora koji ukupno objašnjavaju 49,48% varijance triju skala. U Tablici 4 prikazana je zasićenost pojedinih čestica *Stavova učitelja, Samopouzdanja učitelja, Školske klime i tehničke potpore vezane uz korištenje ICT-em u nastavi* faktorima: *Potpore korištenju ICT-em u nastavi (tehnička i od kolega), Emocionalni odnos učitelja prema ICT-u, Računalo kao agent promjene u odgojno-obrazovnom procesu, Samopouzdanje učitelja vezano uz korištenje ICT-em u nastavi*.

Faktor *Potpore korištenju ICT-em u nastavi (tehnička i od kolega)* objašnjava 14,65% varijance i sastoji se od 10 čestica: *U mojoj školi je primjerena tehnička podrška za korištenje ICT-em u nastavi i školskim aktivnostima; U mojoj školi razni računalni programi dostupni su za korištenje; U mojoj školi postoji primjerena tehnička infrastruktura za korištenje ICT-em u nastavi i školskim aktivnostima; U mojoj školi učiteljima je omogućena primjerena instruktorska podrška u korištenju ICT-a u nastavi i školskim aktivnostima; Ravnatelj u mojoj školi potiče me na korištenje računalom u nastavi; Informatičari u mojoj školi me potiču na korištenje računalom u nastavi; Učitelji u mojoj školi me potiču na korištenje računalom u nastavi, Učitelji u mojoj školi dobro su informirani o važnosti računala za nastavu, I drugi učitelji u mojoj školi koriste se računalom u nastavi, Često razmjenjujem ideje o korištenju ICT-em u nastavi s drugim učiteljima*.

Faktor *Emocionalni odnos učitelja prema ICT-u* objašnjava 14,36% varijance i sastoji se od 8 čestica: *Upotreba računala u nastavi i učenju kod mene izaziva napetost i stres; Plaši me upotreba računala u nastavi i učenju; Skeptičan sam prema korištenju računalom u procesu učenja i poučavanja; Računalo više stvara tehničke probleme nego što pridonosi kvaliteti nastave, Računalo nije jednostavno za korištenje; Ako nešto krene po zlu, neću znati kako to popraviti; Osjećam se ugodno pri pomisli na mogućnost korištenja računalom kao alatom u nastavi i učenju; Entuzijastičan sam u vezi s upotrebom računala kao alata za učenje*.

Faktor *Računalo kao agent promjene u odgojno-obrazovnom procesu* objašnjava 10,82% varijance i sastoji se od 7 čestica: *Računalo će promijeniti način na koji učenici u mom*

razredu uče; Računalo će promijeniti način na koji poučavam; Računalo pomaže učiteljima da njihova predavanja budu učinkovitija; Računalo omogućava učenicima učinkovitije upoznavanje s različitim apstraktnim pojmovima; Računalo pomaže učenicima da izraze svoje mišljenje na bolje načine nego što bi to mogli bez upotrebe računala; Računalo može pomoći učenicima da bolje razumiju određene koncepte; Računalo je vrijedan alat za rad učitelja.

Faktor Samopouzdanje učitelja vezano uz korištenje ICT-em u nastavi objašnjava 9,65% varijance i sastoji se od 7 čestica: Siguran sam da mogu naučiti svoje učenike da odaberu odgovarajući računalni program kojim bi se mogli koristiti u svojim vlastitim projektima; Siguran sam da mogu naučiti svoje učenike da kreiraju vlastite mrežne stranice; Sa sigurnošću mogu dizajnirati tehnologijski napredne obrazovne aktivnosti za svoje učenike; Sa sigurnošću mogu odabrati odgovarajući računalni program za upotrebu na svojim predavanjima; Sa sigurnošću mogu upotrebljavati e-poštu za komunikaciju sa svojim učenicima; Sa sigurnošću se mogu koristiti Power Point-om u svom razredu, Sa sigurnošću se mogu služiti internetom na svojim predavanjima kako bih postigao određene obrazovne ciljeve.

U Tablici 4 prikazane su i vrijednosti karakterističnih korijena ekstrahiranih glavnih komponenti. Karakteristični korijen prvog faktora *Potpورا korištenju ICT-em u nastavi (tehnička i od kolega)* iznosi 4,69, drugog faktora *Emocionalni odnos učitelja prema ICT-u* 4,59, trećeg faktora *Računalo kao agent promjene u odgojno-obrazovnom procesu* 3,46, a četvrtog faktora *Samopouzdanje učitelja vezano za korištenje ICT-a u nastavi* 3,09.

U Tablici 4 prikazane su i vrijednosti Cronbachovog  $\alpha$  koeficijenta za svaki pojedini faktor. Vrijednost Cronbachova  $\alpha$  koeficijenta za faktor *Potpورا korištenju ICT-em u nastavi (tehnička i od kolega)* iznosi 0,87, za faktor *Emocionalni odnos učitelja prema ICT-u* iznosi 0,86, za faktor *Računalo kao agent promjene u odgojno-obrazovnom procesu* iznosi 0,84, a za faktor *Samopouzdanje učitelja vezano uz korištenje ICT-em u nastavi* iznosi 0,88. Ako koeficijent pouzdanosti (Cronbach  $\alpha$ ) poprimi vrijednost oko 0,80 ili više, pouzdanost se može smatrati vrlo dobrom (Kline, 1998). Stoga se može reći da svi navedeni faktori pokazuju visok stupanj pouzdanosti.

Tablica 4.

***Korelacije među faktorima iz faktorskih analiza sljedećih subskala: Poznavanje pojedinih računalnih programa, Učestalost korištenja pojedinih računalnih programa, Stavovi učitelja o integraciji ICT-a u nastavu, Samopouzdanje učitelja povezano s korištenjem ICT-a u nastavi, Školska klima i tehnička potpora.***

Ova studija dio je šireg istraživačkog projekta u kojemu se ispitalo i poznavanje i učestalost upotrebe pojedinih računalnih programa kod učitelja osnovnih škola u gradu Zagrebu pa su na istom uzorku ispitanika već prije primijenjena i faktorizirana dva različita upitnika. Faktorska analiza prvog upitnika ticala se samoprocjene učitelja



o njihovu poznavanju različitih računalnih programa i ekstrahirana su dva faktora: *Poznavanje specijaliziranih računalnih programa* i *Poznavanje uobičajenih računalnih programa* (objašnjavaju ukupno 62,96% varijance upitnika) (Tomić, 2014). Faktorska analiza drugog upitnika ticala se učestalosti upotrebe pojedinih računalnih programa i ekstrahirana su dva faktora: *Korištenje specijaliziranim računalnim programima* i *Korištenje uobičajenim računalnim programima* (objašnjavaju 52,13% varijance upitnika) (Tomić, 2014).

U analizi povezanosti prikazanoj u tablici 5 izračunate su korelacije između navedena četiri faktora dobivena u prethodnoj primjeni dvaju upitnika (Tomić, 2014) i četiri faktora iz faktorske analize provedene na česticama upitnika Stavova o korištenju računalom, Samopouzdanju učitelja vezanom uz korištenje ICT-em u nastavi, Školskoj klimi i tehničkoj potpori u školi čiji su rezultati i prikazani u ovome radu. Korelacije među navedenim faktorima prikazane su u Tablici 5. Faktor *Potpora korištenju ICT-em u nastavi (tehnička i od kolega)* statistički je značajno i pozitivno, ali vrlo nisko povezan s faktorom *Korištenje specijaliziranih računalnih programa* ( $r=0,105$ ). Faktor *Emocionalni odnos učitelja prema ICT-u* statistički je značajno, pozitivno i srednje visoko povezan s faktorom *Poznavanje uobičajenih računalnih programa* ( $r=0,557$ ) kao i s faktorom *Korištenje uobičajenim računalnim programima* ( $r=0,524$ ) a nisko, statistički značajno i negativno povezan s faktorima: *Poznavanje specijaliziranih računalnih programa* ( $r=-0,099$ ) i *Korištenje specijaliziranim računalnim programima* ( $r=-0,118$ ). Faktor *Računalo kao agent promjene u odgojno-obrazovnom procesu* statistički je značajno i pozitivno, ali vrlo nisko povezan s faktorima *Poznavanje uobičajenih računalnih programa* ( $r=0,168$ ) i *Korištenje uobičajenim računalnim programima* ( $r=0,202$ ). Faktor *Samopouzdanje učitelja vezano uz korištenje ICT-em u nastavi* statistički je značajno i pozitivno (srednje visoko do nisko) povezan s faktorima: *Poznavanje specijaliziranih računalnih programa* ( $r=0,486$ ), *Poznavanje uobičajenih računalnih programa* ( $r=0,462$ ), *Korištenje specijaliziranim računalnim programima* ( $r=0,347$ ), *Korištenje uobičajenim računalnim programima* ( $r=0,422$ ). Također, izračunate su i korelacije između faktora *Potpora korištenju ICT-em u nastavi (tehnička i od kolega)*, *Emocionalni odnos učitelja prema ICT-u*, *Računalo kao agent promjene u odgojno-obrazovnom procesu*, *Samopouzdanje učitelja vezano uz korištenje ICT-em u poučavanju*. Nijedna od spomenutih korelacija nije se pokazala značajnom, što je posljedica postupka utvrđivanja faktorskih bodova.

Tablica 5.

## Rasprava i zaključak

Upitnikom kojim su se ispitali učitelji nastojalo se obuhvatiti što veći broj raznovrsnih faktora koji imaju utjecaj na korištenje ICT-em u nastavi zbog toga što većina već upotrijebljenih instrumenata kojima se ispituje integracija ICT-a u nastavu ne obuhvaća sve aspekte tog područja, već su pojedinim instrumentima obuhvaćeni samo neki od spomenutih faktora (Papanastasiou i Angeli, 2008). Metrijske karakteristike takvih instrumenata nisu uvijek jasno određene pa je upitna

i prikladnost njihove primjene. Instrument u ovoj studiji sveobuhvatniji je i njime se nastoji prikupiti kompletnije podatke o različitim aspektima integracije ICT-a u nastavu, što se može smatrati i najvećom prednošću ovog istraživanja.

Rezultati studije pokazuju kako učitelji imaju većinom pozitivne stavove povezane s korištenjem ICT-em u nastavi, vjeruju da je računalo učinkovito pomagalo u nastavi te pomaže i učiteljima i učenicima. Učitelji uglavnom nemaju *cyberfobiju*, tj. strah od računala, a što se tiče samopouzdanja ono je visoko kod korištenja uobičajenim širokoprimjenjivim računalnim programima (npr. Power Point-om), ali se smanjuje kod upotrebe specijaliziranih računalnih programa (npr. programa za izradu mrežnih stranica). Kao što i niske i negativne korelacije pokazuju, emocionalni odnos učitelja prema ICT-u uglavnom ima negativan predznak (strah od računala) kada su u pitanju specijalizirani računalni programi. Budući da na samopouzdanje učitelja direktno utječe dostupnost računala, tehnička potpora i instruktorska podrška (Jamieson-Proctor i sur., 2006), buduće studije trebale bi temeljitije ispitati adekvatnost ICT opreme i instruktorske potpore dostupne u školama. Također, učitelji su uglavnom aspekte školske klime koji su povezani s integracijom ICT-a u nastavu ocijenili pozitivno.

Kako bi se ustanovila konstruktna valjanost upitnika, provedena je faktorska analiza koja je rezultirala s četiri faktora koji se lako interpretiraju i imaju visok stupanj pouzdanosti: *Potpora korištenju ICT-em u nastavi (tehnička i od kolega)*, *Emocionalni odnos učitelja prema ICT-u*, *Računalo kao agent promjene u odgojno-obrazovnom procesu*, *Samopouzdanje učitelja vezano uz upotrebu ICT-a u nastavi*. Faktorska analiza koju su proveli Papanastasiou i Angeli (2008) rezultirala je sa šest faktora: *Pouzdanje povezano s upotrebom ICT-a*, *Potpora kolega*, *Anksioznost (povezana s upotrebom ICT-a)*, *Uvjerenja o vrijednosti računala kao alata u nastavi*, *Tehnička infrastruktura*, *Računalo kao agent promjene u obrazovnom procesu*. Vidljivo je kako su faktori poprilično slični prezentiranim u ovom radu, kako jedan faktor ekstrahiran u ovom istraživanju obuhvaća čestice dvaju faktora iz istraživanja Papanastasiou i Angeli (2008), npr. *Potpora kolega* i *Tehnička infrastruktura* „spojene su“ u faktor *Potpora korištenju ICT-em (tehnička i od kolega)*. Također, druga faktorska iteracija u ovom istraživanju rezultirala je jasnijom faktorskom strukturom od one koja je pokazana u radu Papanastasiou i Angeli (2008) te je pouzdanost svih dobivenih faktora visoka.

Kod dobivenih podataka uočljivo je kako su osjećaji ugođe/neugode pri korištenju računalom kao i samopouzdanje učitelja vezano uz korištenje ICT-em u poučavanju značajno i više od ostalih čimbenika povezani i s poznavanjem i s učestalošću korištenja uobičajenih i specijaliziranih računalnih programa, iz čega proizlazi da je primjena ICT-a u nastavi više povezana s unutarnjim čimbenicima, a manje s onim vanjskim kao što su tehnička podrška i potpora kolega.

Nedostatak ovog istraživanja je mogućnost da su ispitanici davali socijalno prihvatljive odgovore. Stoga bi bilo korisno provesti ponovno testiranje (retest) za dodatnu provjeru pouzdanosti upitnika. Također, potrebno je uzeti u obzir mogućnost

da su procjene učitelja povezane s njihovim ICT kompetencijama subjektivne i da se ne moraju podudarati s mišljenjem vanjskog promatrača. Stoga je potrebno provesti križnu validaciju kako bi se uspostavila podudarnost između uvjerenja učitelja i procjene njihovih sposobnosti od vanjskih promatrača. Na kraju, najpogodnije bi bilo prediktivnu valjanost upitnika unaprijediti objektivnim mjerama računalnih kompetencija. Dodatne informacije dobilo bi se stratificiranjem uzorka po spolu, dobnim grupama i radnom iskustvu.