DETERMINING THE BASIC MOTIVATIONAL FACTORS
OF TEACHERS TO USE ICT IN THEIR TEACHING
USING FACTOR ANALYSIS

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Abstract. Most of the countries worldwide have the development of the Information Society as one of their highest priorities. Education is one of the key segments for the promotion and development of the Information Society. The quality of the educational process depends directly on the information application and its communication technologies. A research has been conducted, in order to investigate the factors that affect the motivation of teachers to use ICT in their teaching and maintain the same. The research was carried out through a survey that was completed by 220 teachers from 10 primary schools of the Southeastern region of the Republic of Macedonia. The questionnaire consisted of 21 factors, out of which 10 were positive and 11 were negative motivation factors for using ICT in teaching. A factor analysis was applied to the given motivational factors which uses a large number of initial values in order to arrive to the basic values; in other words, a large number of original variables are used to obtain a small number of factors. In this case, using the factor analysis on the original 21 variables delivered five separate factors. The survey results were analyzed using the program SPSS 19 and Excel. The views of the teachers on the application of ICT in teaching are positive, the negative factors are insufficient to influence them not to use ICT in teaching.

Keywords: Factor analysis; Motivation; ICT in teaching.

1. Introduction

Information and communication technology (ICT) is an indispensable part of the contemporary world. In fact, culture and society have to be adjusted to meet the challenges of the knowledge age. The pervasiveness of ICT has brought about rapid technological, social, political, and economic transformation, which has eventuated in a network society organised around ICT [8].

The criticism of many studies regarding the effects of ICT on the motivation of students [4] identifies a number of motivational aspects, such as: increasing interest in learning, learning becomes more interesting and more fun, self-confidence and independence in learning.

The analysis of previous research [2-6] identifies a number of factors that ease of use of ICT in the teaching process. In these studies there have been found a range of skills,

competencies and knowledge that allow teachers to easily use ICT in teaching. Some of them are shown in Table 1.

Table 1. Positive and negative factors affecting limited use of ICT [4-5].

positive factors	negative factors
use and experience outside of teaching	difficulties in using the hardware / software
personal computer	requires greater technical support
confidence in the use of computer	not having enough time to use the computer
facilitate preparation of classes	insufficient access to resources
exchange ideas and help from colleagues	limits the contents of lesson plans
easy management of the class	it is costly to be used on a regular basis

As long as teachers do not see the need or do not want to change the traditional way of working, they will probably not accept the use of ICT. However, if they see ICT experience as something that will be useful to them, their professional development, and to improve student achievement, the likelihood to have a positive view towards the use of ICT in teaching is greater. Some of the factors that contribute to the ICT usability are given in Table 2.

Table 2. Positive and negative factors affecting the usability of ICT use [4-5].

Positive factors	Negative factors
makes lessons more interesting	makes difficult lessons
makes them different lessons	makes them less interesting lessons
allows for better presentation of the material	reduces motivation among students
strengthens my confidence	I do not feel comfortable
paperwork makes more efficient	restricts lessons
improves my position in school	I took too much time

The view of the teachers regarding these factors depends on how they perceive the use of ICT for their personal needs and their teaching.

According to the model of technology acceptance (Davis, Bagozzi and Warshaw, 1989), the more positive views to the above factors for limited use and benefits of ICT, the more positive views of teachers to use ICT and the likelihood that they will use ICT in teaching increases.

2. Methodology

The legislative changes in education in the Republic of Macedonia require the system to carry out modernization of the educational process by applying 30% of ICT in teaching. Given this need, a research has been done to investigate the factors that affect the motivation of teachers to use ICT in their teaching and to maintain their usage. The aim of the research is to use some already identified factors that affect the development of ICT competence and its integration in teaching and learning in terms of recommending professional development and encouraging teachers to use ICT in teaching in order to improve their future effectiveness.

The survey was conducted in the academic year 2012/13 in 10 primary schools in the Southeast region of The Republic of Macedonia in Strumica, Vasilevo Bosilovo and Novo Selo. The conducted survey included 214 teachers (which is an adequate sample considering 610, which is the total number of teachers employed in these municipalities).

The subject of the research was:

1. To discover the motivational experiences that teachers have with ICT use in teaching, the support they receive as well as their personal development.

2. To establish the connection between their motivational experiences and their perceptions of the advantages and disadvantages of using ICT.

3. To single out the most important factors that influence teachers' motivation to use ICT.

During this research, a survey was developed, which collected information regarding the teachers' ICT experience, training, use of software, hardware, and their ICT competencies. The main parts of the survey are presented in Table 3.

Table 3. Key parts of the survey ICT application in teaching for teachers in primary schools.

part	Title of section	information	Number of issues
I	General information	environment, age, experience, sex, teacher	5
II	Using a computer for personal needs	personal computer, type of computer, Internet at home, years of experience with computer	4
III	Personal and professional development	training classes at school, additional training, self-improvement	3
IV	Using computers at school	implementation of ICT programs, type of computer, hardware, use of computer	6
V	Motivation for using ICT in teaching	motivational view with scale assessment	21
VI	ICT knowledge and skills	navigation in the operating system, email, Internet, text editor, multimedia presentations, spreadsheet calculations, blogs, databases	8
VII	ICT in school	assessment scale for the application of ICT in school	3
		Total Questions	33

3. Results and discussion

The analysis of the survey results is presented in three parts. The first part consists of descriptive statistics of the sample. The second part presents the results of relevant factors associated with motivation. The third part consists of significant correlations between motivation and relevant factors. The survey results were analyzed using the program SPSS 19 and Excel and are presented below.

Table 4. Age of the sample.

Age	Number of teachers	Percentage
<=25	5	2,3%
26-35	59	27,6%
36-45	55	25,7%
46-55	71	33,2%
>=56	24	11,2%

The mean age of sample is 43 years, indicating that the sample included teachers of all ages, not just young teachers who are considered to have more experience and have more ICT competencies. 83% of respondents are female and 17% male, which reflects the tendency of the teaching profession.

The sample consisted of 105 urban teachers and 109 rural teachers. From the sample 85 or 39.7% were from elementary, while 129 or 60.3 % were from the middle school classes. The survey also included teachers with different experience as shown in Figure 1.
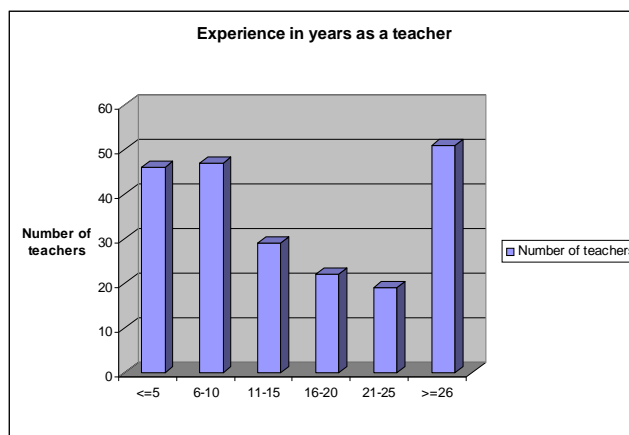
Figure 1. Experience in years as a teacher.

The survey consisted of 21 factors, 10 positive and 11 negative regarding the motivation for using ICT in teaching.

Table 5 shows the mean values of responses to the motivational factors given in the survey. The motivational factors are evaluated on a scale of 0 to 4. The first 9 factors have received a higher score of approximately 3. The highest ranked statement: "ICT makes lessons more interesting for students" was assigned a medium grade 3 which means that most of the teachers agree. The statement: "The use of ICT improves access to computers for personal and professional use" was asigned with an average grade of 2,95; then "The use of ICT facilitates administrative work" with an average grade of 2,91; "The application of ICT improves curriculum presentation" with an average grade of 2,79; "The application of ICT deepens the knowledge of students" with an average grade of 2,74; "The application of ICT in teaching strengthens my confidence in using computers" with an average grade of 2,70; "ICT makes my lessons very different" with an average grade of 2,69; "The use of ICT in teaching is a challenge for me" with an average grade of 2,66 and the statement: "The use of ICT in teaching enhances the prospects of my career as a teacher" with an average grade of 2,60. Seven factors were assessed at an average grade 2, thus the statement "The use of ICT makes me more powerful in teaching and school" has an average grade of 2,44; "Hardware and software problems encountered frequently ruin my class" has an average grade of 2,22; "The use of ICT is counterproductive due to lack of resources" has an average grade of 2,07; "Application of ICT consumes significant amount time in preparing lessons" has an average grade of 1,90; "The application of ICT distracts the students" has an average grade of 1,72; "The use of ICT is not a challenge for me" has an average grade of 1,55; and "The use of ICT disrupts learning in students" has an average grade of 1,50. The remaining 5 were assessed with an average grade of 1, thus the statement "The use of ICT reduces the lesson content" has an average grade of 1,49; the statement "The use of ICT makes lesson content more difficult" has an average grade of 1,33; the statement "The use of ICT reduces motivation among students" has an average grade of 1,32; the statement "The use of ICT makes lesson content less interesting" has an average grade of 1,23. Finally the lowest evaluated is the statement "The use of ICT reduces my ability as a teacher" received a mean 1.14 which means that most of the teachers disagree.

These findings show that the majority of teachers believe that ICT improves the presentation of the material, making the lessons more interesting, deepens knowledge of the students, facilitates administrative work and diversifies the curricula. The mean of the responses for negative view is low indicating that most of the teachers do not agree that: ICT reduces the ability of students, distracts them, disrupts learning among students, and makes lessons less interesting and more difficult.

For all previously given motivational factors we applied factor analysis which took in large number of initial variables and received a few basic values; in other words, from a range of original variables we get a few factors. Factor analysis on the initial 21 variables resulted in five separate factors.

For the conduction of the factor analysis the program SPSS 19 is used.

Table 5. Advantages and disadvantages of using ICT in teaching (higher value means more agreement).

Descriptive Statistics	Mean	Std. Deviation	N
ICT makes lessons more interesting for students	3,00	,790	214
The use of ICT in teaching is a challenge for me	2,66	,866	214
The application of ICT improves curriculum presentation	2,79	,858	214
The use of ICT facilitates administrative work	2,91	,979	214
ICT makes my lessons very different	2,69	,792	214
The application of ICT in teaching strengthens my confidence in using computers	2,70	,928	214
The use of ICT improves access to computers for personal and professional use	2,95	,711	214
The use of ICT in teaching enhances the prospects of my career as a teacher	2,60	,908	214
The application of ICT deepens the knowledge of students	2,74	,820	214
The use of ICT makes me more powerful in teaching and school	2,44	,921	214
The use of ICT is counterproductive due to lack of resources	2,07	,914	214
Hardware and software problems encountered frequently ruin my class	2,22	1,028	214
Application of ICT consumes significant amount time in preparing lessons	1,90	,880	214
The use of ICT makes lesson content more difficult	1,33	,761	214
The use of ICT makes lesson content less interesting	1,23	,713	214
The use of ICT reduces the lesson content	1,49	,780	214
The use of ICT reduces motivation among students	1,32	,788	214
The use of ICT disrupts learning in students	1,50	,832	214
The use of ICT is not a challenge for me	1,55	,927	214
The application of ICT distracts the students	1,72	,890	214
The use of ICT reduces my abilities as a teacher	1,14	,772	214

Examination of the correlation matrix confirmed that the data are adequate to implement factor analysis. The criterion for the application of factor analysis is the value of Kaiser-Meyer-Olkin-index. The KMO index of motivational factors is 0.891; this confirms that the data collected for motivational factors is appropriate to implement factor analysis.
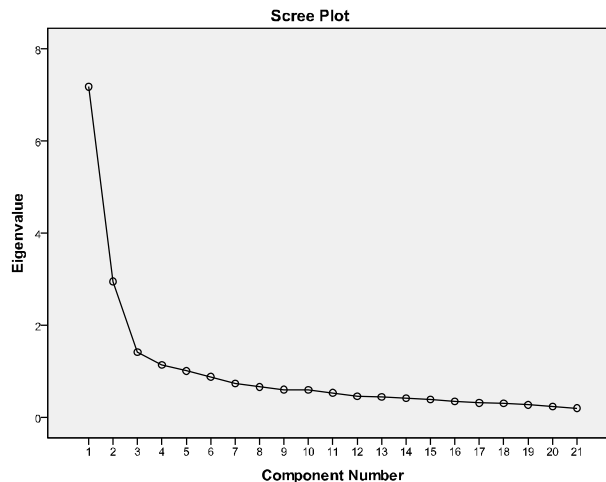
Scree Plot

From the Cattell (scree plot) diagram with 21 variables, Figure 2 shows that five factors are distinguished, because their values are distinguished from the values of the rest of the factors. The interpretation of the factors is made from the matrix of the factor structure following the rotation of factors and variable identification that have high absolute load on the same factor. The rotation of the factor is done with orthogonal rotation of the factor, i.e., the method Varimax is used.

Table 6. Identifying the variables that have high absolute loading in the same factor.
Rotated Component Matrix[a]

	Component				
	1	2	3	4	5
The use of ICT in teaching enhances the prospects of my career as a teacher	,858				
The use of ICT makes me more powerful in teaching and school	,797				
The use of ICT improves access to computers for personal and professional use	,781				
The application of ICT in teaching strengthens my confidence in using computers	,779				
The application of ICT deepens the knowledge of students	,743				
ICT makes my lessons very different	,735				
The use of ICT facilitates administrative work	,688				
The application of ICT improves curriculum presentation	,679				
The use of ICT in teaching is a challenge for me	,547				,518
ICT makes lessons more interesting for students	,540				,535
The use of ICT reduces motivation among students		,810			
The use of ICT is not a challenge for me		,761			
The use of ICT disrupts learning in students		,734			
The application of ICT distracts the students		,697			
The use of ICT makes lesson content less interesting		,551	,413		
Application of ICT consumes significant amount time in preparing lessons			,738		
The use of ICT makes lesson content more difficult		,511	,645		
The use of ICT reduces my abilities as a teacher		,467	,546		
Hardware and software problems encountered frequently ruin my class				,815	
The use of ICT is counterproductive due to lack of resources				,811	
The use of ICT reduces the lesson content					,728

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 6 iterations.

The resulting five factors based on the 21 variables are:

Factor 1. ICT improves, facilitates and strengthens my position as a teacher, consists of the variables:
- The use of ICT in teaching enhances the prospects of my career as a teacher
- The use of ICT makes me more powerful in teaching and school
- The use of ICT improves computer access for personal and professional use
- The use of ICT in teaching strengthens my confidence in using computers
- The use of ICT deepens the knowledge of students
- The use of ICT makes my lessons very different
- The use of ICT facilitates administrative work
- The use of ICT improves the curriculum presentation

Factor 2. The use of ICT disrupts learning and motivation of students and is not challenging for me, consists of the variables:

- The use of ICT reduces motivation in students
- The use of ICT is not challenging for me
- The use of ICT disrupts learning in students
- The use of ICT to distracts the students

Factor 3. The use of ICT makes my class content more difficult and less interesting and reduces my ability as a teacher, consists of the variables:
- The use of ICT to make lessons less interesting
- The use of ICT consumes a lot of my time in preparing lessons
- The use of ICT makes the lesson content more difficult
- The use of ICT reduces my ability as a teacher

Factor 4. The use of ICT is counterproductive because of lack of resources and hardware and software problems that I encounter, consists of the variables:
- Hardware and software problems that I encountered frequently ruin my class
- The use of ICT is counterproductive due to lack of resources

Factor 5. The use of ICT makes positive changes in curriculum and is challenging for me, consists of the variables:
- The use of ICT in teaching is challenging for me
- The use of ICT makes lessons more interesting for students
- The use of ICT reduces the class contents

The empirical research on motivational factors and the application of the factor analysis of the collected data aimed to reduce the large number of factors to a small number of basic motivational factors for teachers. The determination of basic motivational factors for teachers is important in order to achieve a higher degree of application of ICT in teaching, and thus modernize and increase the efficiency of the teaching process.

4. Conclusion

The analysis of the results of motivational factors of teachers showed that many factors influence teachers' use of ICT in teaching.

The views of teachers on the application of ICT in teaching are positive, and their belief that ICT improves the presentation of the material makes the lessons more interesting, deepens the knowledge of students, facilitates administrative work, and makes the teaching content different.

Everyday use of the computer for personal purposes has a positive impact on the use of ICT in teaching. Teachers who regularly use ICT are more confident, their prospects as teachers are improving, and they are more powerful in the classroom and school. This suggests that additional training courses for teachers with lesser ICT competences will increase the number of teachers who use ICT in teaching.

Negative factors are not sufficient to influence teachers not to use ICT in teaching. They disagree that ICT reduces the students' capability, distracts students, disrupts learning among students, makes curriculum less interesting and difficult.

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