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Factors Affecting the Development of ICT Competencies of Teachers in Primary Schools

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Abstract

A research was conducted in order to ensure valid and reliable assessment of the extent of ICT knowledge and skills of teachers in primary schools, to identify the factors in terms of teachers affecting the development of ICT competences, and to identify strategies to improve the development of effectiveness in the future. The research surveyed 220 teachers from 10 primary schools of Macedonia. The Technique SEM was used to determine the relative strength of influence of factors on ICT competencies of teachers. The results show that 25% of the teachers have below basic ICT Competency, 17% of teachers have basic knowledge and skills to operate a computer, and the highest percentage, 58% of teachers with proficient ICT competence.

Keywords: ICT knowledge and skills; ICT in teaching; Modeling with structural equations

1. Introduction

Information and communication technologies (ICT) play a proven critical role in enhancing the quality of education. They are particularly important in helping teachers and students to perform more effectively. To make the best use of ICT, teachers must be equipped with adequate ICT competencies. In the process of integrating ICT into education, both teacher's ICT competencies and how they perceive the role of ICT in their teaching/learning processes play key roles. Analysis, design, development, implementation, evaluation, and management of ICT in

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education require diversified competencies and knowledge (Kozma 2002, pp.1-6). Today, improved communication technology has made time and space less complex. It could be observed that this modern age is the age of information explosion in which an average individual wants to explore the information system. Thus, the ability for timely acquisition, utilization, communication and retrieval of relevant and accurate information has become an important attribute for better teaching-learning process. (Adebayo, 2008). The new technologies have the potential to support education across curriculum and provide opportunities for effective communication between teacher and students in ways that have not been possible before. ICT in education has the potential to be influential in bringing about changes in ways of teaching (Dawes, 2001). Teachers contribute toward the base of the education innovation, therefore ICT competencies of teachers in primary schools should be seen as an invaluable prerequisite to facilitate teaching and learning in this modern era of information and technology. ICT is not only a means of realizing the educational goals but important factor in a complete restructuring of the educational system, introducing new interactive and participatory models of education, new educational pedagogy, continuous and lifelong learning. Macedonian context of computerization and digitization of education intensively developed after 2002 when the country received the first Chinese donation, which allowed a certaindegree of popularization of ICT in the education. Starting in 2003 through the e-school project teacher training the use of ICT was conducted in two phases. With changes in education that occurred with the intensive introduction in education resulted in a need to develop national educational policies and strategies that will contribute to the social and educational development. In 2005 was created the draft program for the development of ICT in education (2005-2015) which covered the process of computerization and digitization of education. Macedonia entered the world of ICT innovation with the introduction of the program "Computer for Every Child" initiative and investment by the Government of the Republic of Macedonia to modernize Macedonian education. This project provides a computer for each child, software solutions and tools for each subject, advanced ICT skills among teachers and students, a national system of testing students and the interactive online teaching. In the academic year 2009/2010, primary schools were equipped with portable Classmate PCs for every student from first to third grade. In 2010 teacher trainings were conducted for Edubuntu operating system, the programs for integration of mathematics and sciences, ToolKid program and SSTC of using "thin clients". Furthermore, despite the software electronic grades were introduced. Also attached is training for class teachers for the program and Green G Compris suite-junior. Starting from the academic year 2013/14, all teachers were required to integrate at least 30% of ICT in the curriculum.

2. Methodology

This research is done in order to ensure valid and reliable assessment of the extent and nature of ICT knowledge and skills of teachers in primary schools, as well as to identify the factors of teachers' views affecting the development of ICT competences. The survey was conducted in the academic year 2012/13, in 10 primary schools in the Southeast region of the Republic of Macedonia: Strumica, Vasilevo, Bosilovo, and Novo Selo. The conducted survey included 220 teachers. In the survey every teacher had to report their ICT knowledge and skills, the ways in which they use ICT in teaching, ICT trainingthey have attended, frequency of ICT use in teaching and to evaluate motivational attitudes of the ICT use in teaching, and the attitudes of the school towards ICT. The main parts of the survey are shown in Table 1.

Table 1. Structure of the ICT survey 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 the 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,	8

	blogs, databases		
VII	ICT in school	assessment scale for the application of ICT in school	3
	Total Questions		33

3. Results and discussion

The survey results were analyzed using SPSS 19 programs, Excel and Amos Graphics 18. The tables below present the demographic characteristics of the surveyed teachers.

Table 2. The location of the school.

Location					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Rural	105	49,1	49,1	49,1
	Urban	109	50,9	50,9	100,0
	Total	214	100,0	100,0	

Table 2 shows that almost equal number of teachers are from urban and rural areas.

Table 3. Age structure of the surveyed teachers.

Age					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<=25	5	2,3	2,3	2,3
	>=56	24	11,2	11,2	13,6
	26-35	59	27,6	27,6	41,1
	36-45	55	25,7	25,7	66,8
	46-55	71	33,2	33,2	100,0
	Total	214	100,0	100,0	

Table 4. Work experience as a teacher.

Experience					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<=5	46	21,5	21,5	21,5
	>=26	51	23,8	23,8	45,3
	11-15	29	13,6	13,6	58,9
	16-20	22	10,3	10,3	69,2
	21-25	19	8,9	8,9	78,0
	6-10	47	22,0	22,0	100,0
	Total	214	100,0	100,0	

Table 5. Gender of surveyed teachers.

Gender		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	177	82,7	82,7	82,7
	Male	37	17,3	17,3	100,0
	Total	214	100,0	100,0	

Table 6. Teachers from primary education.

Teacher		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Primary education teacher	85	39,7	39,7	39,7
	Subject teacher	129	60,3	60,3	100,0
	Total	214	100,0	100,0	

In the survey the teachers responded regarding their use of eight most used ICT applications:
• Navigation in OS
• Electronic mail
• Internet
• Text editor (Word, OpenOffice Writer, ...)
• Multimedia presentations (Power Point, OpenOffice Impress, ...)
• Spreadsheets (Excel, OpenOffice Calc, ...)
• Blogs
• Databases
For each software application was given a list of skills that teachers chose the ones they posses.
The use of ICT applications by teachers is different, as shown in Table 7

Table 7. Use of ICT applications by teachers.

	Percentage of use *
Base: All respondents	n=214
Navigation in OS	90%
Email	89%
Internet	94%
Text editor (Word, Open Office Writer ...)	94%
Multimedia presentations (Power Point, Open Office Impress ...)	81%
Spreadsheets (Excel, Open Office Calc ...)	79%
Blogs	10%
Databases	4%

* Percentage of teachers who said they use the application

The Basic ICT applications which are used by 94% of the teachers are online and text editor. The application navigation in operating system was used by 90%, email by 89%, and multimedia presentations by 81%. Then, spreadsheets used by 79%, and blogs used by only 10% of the respondents. The lowest percentage of respondents – 4% are using databases for the purposes of teaching. In order to provide an easier way of applying statistics, the results of the survey were summarized for ICT competencies. Each of the answers for the given eight skills to work

with a computer was assigned a score. The total number of points gives the result for ICT competence. The results of ICT competences are given in Figure 1. The graph shows that 25% of the teachers have the least ICT Competency, with less than 40 points. 17% of teachers have 41 to 70 points for the knowledge and skills of computer operation, and the highest percentage, 58% of teachers got 71 of the 129 points for ICT skills. So we can conclude that most teachers have high ICT competence, then teachers who have acquired basic knowledge and skills to work with a computer, the teachers in the middle are the least.
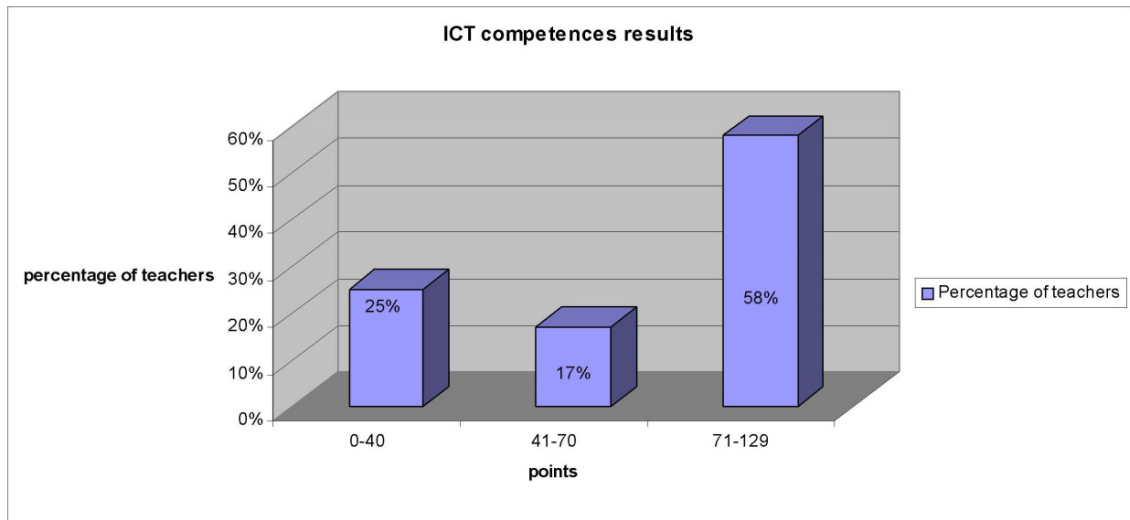

Figure 1. Graphical representation of the ICT competences results.

When analyzing the results of ICT competence we came to some key factors that influence the teachers' ICT knowledge and skills. This decision is useful for the future when providing recommendations for the development of ICT knowledge and skills.

Factors found to affect the ICT knowledge and skills of teachers will be considered as:
- demographic factors and
- other factors.

The following demographic factors have a significant relationship with the teacher's ICT competence.
  o **Gender:** Men are more likely to have higher ICT competence than women .
  o **Age:**   ICT competence score decreases as age increases for teachers .
  o **Work experience:** The results of ICT competence score decrease as the experience of teachers in years increase, this undoubtedly is due to the relationship between age and experience of teaching.
  o **Subject / elementary teacher:** The teachers teaching subjects are more likely to have higher scores in ICT competence than teachers in elementary school.

A factor which is not significantly associated with ICT competence (ie no statistically significant relationship exist between this factor and the results of ICT competence) is:
  ▪ **The location of the school (urban or rural)**

As shown in Figure 2 the result of ICT competences is higher among men than women. The mean value for men is 69.05, while that of women is 64.51.
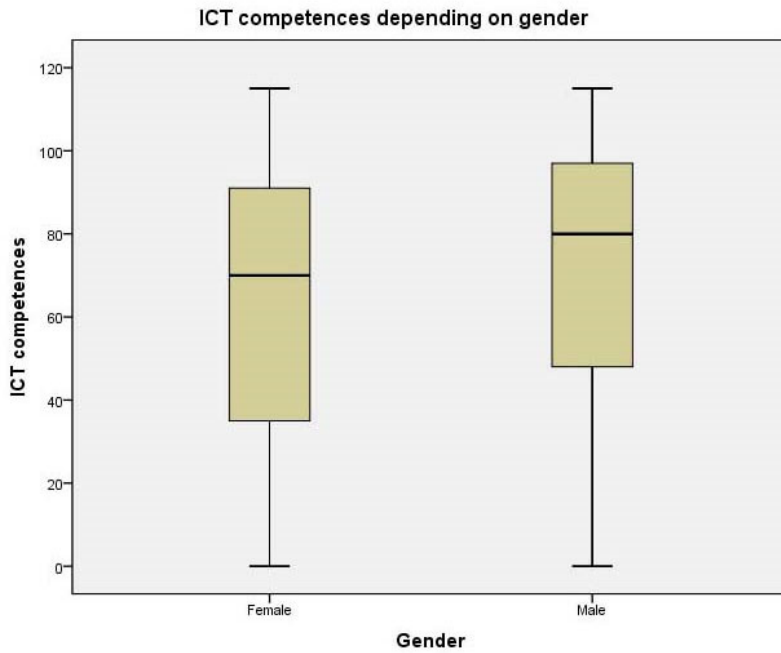
Figure 2. ICT competences depending on gender.

Figure 3 below shows that the age of teachers is inversely related to ICT competences. The average result for ICT competencies decreases, with statistically significant degree, with the age of the teachers.
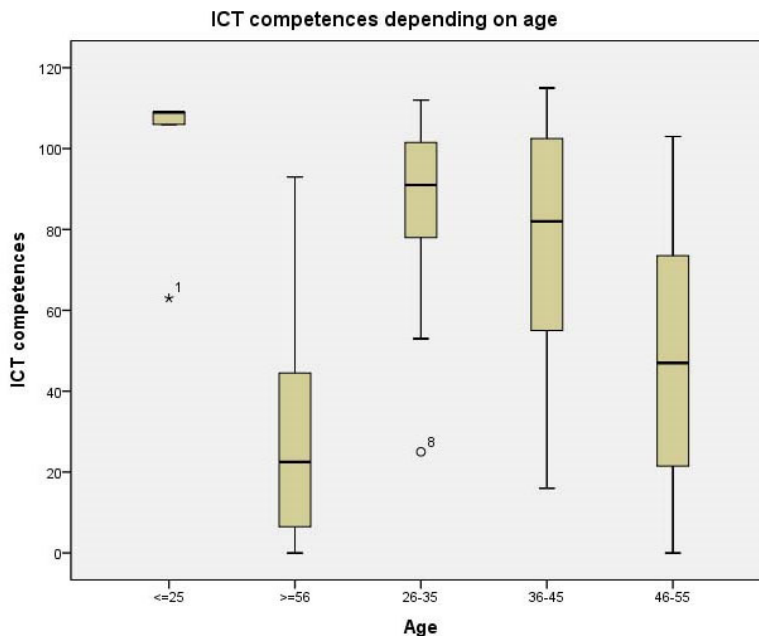

Figure 3. ICT competences depending on age.

Technique Modelling with Structural Equations was used to analyze the relationship between ICT knowledge and skills of teachers and the factors that influence them. Structural equation modelling examines the strength of the relationship between variables and assigns weight ratio, which could be anywhere between 0 and 1. It was found that the strongest factors related to ICT knowledge and skills are: professional use of ICT, school ICT capacity, personal computer, teacher attitudes and motivation. These relationships are shown in the model below.
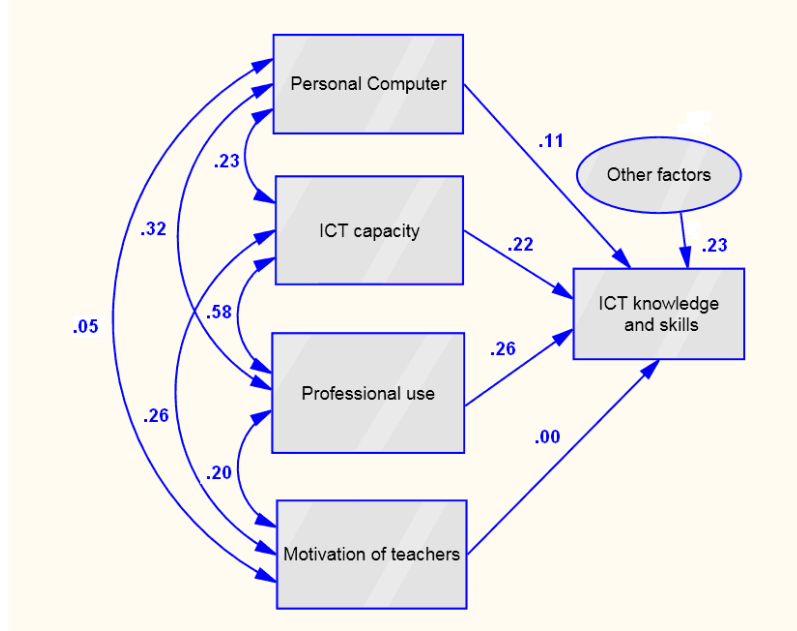

Figure 4. Relative strength of influence of factors on ICT competencies of teachers.

From Figure 4 we can conclude that the professional use is the strongest impact factor of ICT knowledge and skills, which measured 0.26, then comes ICT capacity of 0.22, personal computer measured 0.11, but the motivational factor, which measured 0.004 is negligible. The impact of other factors on ICT knowledge and skills is 0.23.

When we collect the results of all factors that influence the ICT knowledge and skills we get a value 0.604 (0 to 1). This means that all these factors are 60.4% of the variance of ICT knowledge and skills and suggests that these factors describe well the impact on ICT knowledge and skills.

Table 8. Regression weight factors for ICT knowledge and skills. Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
ICT knowledge and skills	<---	Personal Computer	13.443	7.510	1.790	.073	
ICT knowledge and skills	<---	ICT capacity	5.043	1.723	2.927	.003	
ICT knowledge and skills	<---	Professional use	4.024	1.158	3.475	***	
ICT knowledge and skills	<---	Motivation of teachers	.208	3.663	.057	.955	

Table 9. Overview of the model in SPSS.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,480[a]	,231	,216	33,734

a. Predictors: (Constant), Motivation of teachers, Personal computer, ICT capacity,

Professional use

Table 9 gives us a summary of the model in SPSS, where we can see that the value of R Square is 0.231 indicating that the model is correct.

4. Conclusion

Since the ultimate goal is to achieve a higher level of ICT competence of teachers, then using the factors that contribute as a guide is a step forward. The increase in professional use of ICT will positively affect the increase of ICT competencies of teachers. The key areas are:
• contacting colleagues online
• creating class materials by using web resources, consumables, software etc.
• administration

Continualy improving the technical equipment in the schools that will positively affect the use of ICT by teachers. Access to hardware and computers contribute to greater development of ICT competencies of teachers.

Motivational attitudes of teachers in general are positive and indicate a need for small improvement.

Training teachers regarding spreadsheets, multimedia presentations, blogs and databases will have a positive impact on ICT knowledge and skills of teachers in the corresponding areas.

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