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IMPLEMENTATION OF THE INFORMATION AND COMMUNICATION TECHNOLOGY IN LEARNING

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ABSTRACT: Information and Communications Technology (ICT) has a great importance in all aspects of life, including education as well. With the fast technology progress, its implementation in education is inevitable. This paper shows the implementation of ICT in education, beginning with its definition, indicators, techniques and methods of implementation, the obstacles that the implementation faces, and some good implementation practices performed in Mathematics. All the above mentioned aspects are described in this paper including the cycle of subject organization through ICT, which is followed by the creation of electronic files for teachers and students illustrated by an example of the way of organizing these files. There is also discussed for the lesson planning in Mathematics using available applications for each teacher in the R. of Macedonia. This research covers the teachers of the R. of Macedonia of different ages which come both from elementary and high schools. We show the level of Information and Communications Technology usage in education; the obstacles for not implementing it by the teachers; the ways of communication between the teachers; student arrangement and grouping while using Information and Communications Technology; types of applications that the students use; the impact of the ICT on the students; the impact of the ICT on the role of the teacher; the ways of evaluating the students' work by using ICT. Some of the results found by this research are compared by the results found by the research done by the *Institute for Applied Social Science(IT*S) with teachers from Germany, Ireland, Spain, Netherlands and Belgium.

Key words: ICT, indicators, standards, methods, implementation

INTRODUCTION

ICT has became one of the main factors not only in the learning and teaching process, but also it has become an important part of most organizations and businesses (Zhang & Aikman, 2007). ICT covers a large set of devices and tools such as the computers, hardware elements, computer software's, other telecommunication objects etc. (Orby theam, 2005). ICT comprise the use of at least one computer, that convert the information (text, images, sounds, motion) into general digital formats (Lover-Duffy et al. 2003, USDE, 2000; ISTE, 1999). Incorporation of ICT in the teaching and learning process means a change in the traditional methods of learning and teaching. The increasing of using the ICT is the big challenge both for teachers and pupils (Smeets et al. 1999). In (Look, 2005) one can see that students in technology rich environments experienced positive effects on achievement in all subject areas. The ICT activities in the class can be categorized as the combination of devices, learning methods and managing with pupils in the class (Veen, 1994). By the time ICT becomes the integral part of the educational system (Moutlana, 2007). It can increase the educational level in many forms and in many areas (Walsh, 2009). In (Sara et al. 2010) one can see that ICT is very useful because it makes the educational process easier. Even this, the ICT is not used and implemented everywhere. There are different factors and barriers which have the influence in not using the ICT. In (Yildirim 2007) one can find the main factors and reasons of not implementing the ICT. On the other hand in (Hadi & Zeina 2012) one can find the research concerning the barriers of not implementing the ICT. These barriers are categorized into different groups. Some recommendations and classification of these barriers may be found in (Ertmer 1999), (Bingimlas 2009), (Garcia

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& Francisco 2008) and (Cathleen & Elliot 2011). Studying the obstacles of using ICT in educational process, may assist teachers and others to overcome the barriers and become successful ICT users in the future. Although the ICT cannot replace normal classroom teaching (Kelleher 2000), it has a very important role on the direction of deeper understanding of the principles and concepts of science and could be used to provide new ideas and activities which are very creative, useful, interesting and motivating. Due to ICT's importance in society in general, and especially as the important tool in the process of education in future, identifying the possible obstacles to the integration of the ICT in School would be very important step in improving the educative process. By this research we analyze the situation in the Republic of Macedonia. What is the level of using the ICT in the schools in Macedonia (both elementary and high schools). What is the opinion of teachers concerning the actual situation as well as for different problems they are facing with applying these technologies. This analyze is done after the decision of the government of Republic of Macedonia to implement the project "computer for every pupil". By this project there were displayed 20000 personal computers in the schools of Macedonia, followed by approximately 100000 LCD monitors, tasters, mousses etc. For 2016 the government also plans to invest the smart tablet for every pupil (approximately 300000 tablets). Taking this into the consideration, we want to see the level of implementing the ICT in the schools of the Republic of Macedonia. Is the mentioned investment by the government productive? What is the comparison of using ICT in Macedonia with the other countries? What are the barriers of using ICT in Macedonia? Are the pupils and teachers satisfied? What are the recommendations? Etc.

METHODS

The population of the study is consisted of the teachers from high and elementary schools in Republic of Macedonia. During the academic year 2014-2015 we surveyed 238 randomly chosen teachers.

For this purpose we have prepared the questionnaire consisted of questions concerning some important data about the using of ICT in the educational process, the school they are coming from, as well as questions concerning difficulties that they are faced during the using the ICT in the teaching process. There were also questions about the encouragement and help that they take from the schools and other institutions. Also there were the question followed by the information for the test scores on Mathematics and Albanian language.

In order to get a clear illustration concerning the interpretation of the gathered data, making conclusions and decisions, we have used the Statistical Analysis Software SPSS.

At the beginning we have analyzed some elements from the descriptive statistics concerning some characteristics, and then we continued with an analysis concerning some other statistical values and dependencies. For analyzing the obtained data in this research we have used cross tabulations. This is done with the purpose to get the clearer picture for the topic of discussion. We have used the chi-square test, the so called t-testing as well as the regresion relationship between some variables.

RESULTS and DISCUSSION

From the processed data we can see that 76% of teachers have confirmed to have the personal computer. 73% of teachers have available internet connection in any time. So, majority of teachers in Republic of Macedonia have the basic knowledge possible recourses for using and applying the ICT. On the other hand just 25% of teachers are answering that they can use the special classrooms equipped by computers and internet connections in order to use the ICT in the teaching process. The obtained results are unsatisfactory compared by the research performed on the USA (Teachers use of educational technology in U.S. Public Schools, 2009) where one can find that 97% have basic conditions (equipped classrooms) and 93% have access to internet any time.
On the other hand concerning the information about the level of usage of computers in the teaching process, the obtained answers are satisfactory compare with the research done from the institute for applied sciences in Germany, Ireland, Spain, Holland and Belgium. Just 1% of teachers in Macedonia are answering that they do not use computers and just 14% are answering that they use them rarely. 33% use sometimes, 20% often and 23% always. Compared with the mentioned research above these are very good results, because on the mentioned countries just 8% are using always computers in the teaching process, 10% are using often and 29% sometimes. 53% are not using the computers. This information gives a very big difference with the answers in Macedonia.

From the teachers who have answered with yes to the question if they use ICT, 59% of them have answered that they use ICT for solving problems and 26% for writing texts. Another obtained answer is that 64% of teachers are using ICT for training purposes and 38% of them for other applications concerning the subject they are covering.

The answers to the question about the way the teachers help the students in using ICT are as follows: 53% of teachers always are checking the work of the students when they work with ICT, 33% of teachers often do that and 9% are doing such controls sometimes. Just 5% of teachers answered that they do not check the students at all. These results are very similar with the research done by the Institute of Applied and Social Sciences (ITS), where the percentages are 51%, 30%, 12% and 7% respectively. Another interesting result is that 48% of teachers spend more time with the students which have difficulties using ICT. This percentage is bigger compared with the result obtained by ITS, which is 40%.
Analyzing the gathered data one can conclude that 51% of teachers agree that using ICT they are playing more the role of trainers than lecturers. 15% have responded that strongly agree with this conclusion compared with just 29% who disagree and 10% which strongly disagree with this conclusion. These results are similar with the conclusion of ITS institute, where these percentages are 66%, 18%, 12% and 4% respectively. Similar conclusions can be done for some other issues as well. Concerning the time that they spend with students who have needs for additional help the results are as follows: 49% of teachers agree and 15% of teachers strongly agree with the fact that they have more time to spend with this category of students if they use ICT. On the other hand 31% of teachers disagree and 10% strongly disagree with this conclusion. The same results obtained from ITS institute are 58%, 13%, 25% and 4% respectively. This means that in Macedonia using ICT influences more in working with students in needs, compared with other countries.

Concerning the efficiency of the teaching process when teachers use ICT the answers are as follows: 57% of teachers agree that they are more effective when they use ICT and 10% strongly agree with this conclusion. On the other hand 25% disagree with this, and only 10% of teachers strongly disagree with this conclusion. Concerning this issue the obtained results are very similar to the results of the ITS institute where the percentages are 58%, 13%, 25% and 4% respectively.

Concerning the improvement of the communication skills, 57% of teachers agree that they have better communication with the students when they use ICT. 11% of teachers strongly agree with this conclusion. On the other hand 27% of teachers disagree with this conclusion and just 5% of teachers strongly disagree with this conclusion. Comparing by the results obtained from the ITS institute one can conclude that concerning this issue, the results obtained in Macedonia are better. For the same conclusion the research done by ITS has got the following percentages: 49% agree with the conclusion, versus 39% of teachers who disagree with the conclusion.

Another thing which one can conclude by this research is that 29% of teachers have declared that they are under the pressure (or simply they feel stressful) when the use ICT. On the other hand 44% of teachers disagree with this and they have answered that they are not under any stress. These results are little bit worse compared with the results obtained from the ITS institute. According this institute the obtained percentages are 21% of teachers who agree versus 56% of teachers who have answered with disagree.

Concerning the students arrangement using ICT we have got the following answers: From all teachers from elementary schools who are using ICT in the teaching process, in 30% of cases they often divide the students in pairs, 47% of elementary teachers have declared that that pupils often are working individually, 47% of teachers have declared that pupils work often in small groups and just 33% of teachers have declared that when they use ICT they work by the whole class in parallel. These results are different compared by the same percentages obtained from the ITS institute. Concerning the research of the ITS institute the results with the pupils from elementary schools are 43%, 16%, 26% and 8% respectively. The results show that in Macedonia when teachers use ICT, pupils more are working individually or frontally with the whole class, versus the other European countries where the using of ICT in the teaching process is followed by the group work. Concerning the same issue with the students from high schools, the results are as follows: 24% of teachers divide students in pairs when they use ICT, 33% of teachers have answered that the students work often individually when they use ICT, 48% of cases are answering that students work in small groups when they use ICT and 35% have answered that they work with the whole class when they use ICT. The same results obtained from the ITS institute are 37%, 24%, 4% and 4% respectively. All categories except the working in pairs have bigger percentage in Macedonia compared by other European countries.

On this paper we have also analyzed the ways on how the ICT affects the initial stage of preparation for the subject. By using ICT, 66% of teachers have declared that they are more efficient in preparing different teaching materials as textbooks, tests, quizzes etc. 20% are answered that there is no any change concerning this issue. Just 6% of teachers have declared that on this aspect they have more difficulties compared with the traditional methods. 73% of teachers are using different online sources for the topics concerning the lesson. 72% of teachers agree that using the ICT they can improve their professional development. Just 5% of teachers think that professionally they are not developed when using ICT and 15% of teachers think that they are professionally developed on the same way with and without using ICT. Compared with the research done by the ITS institute this is bigger percentage. The research done from the ITS institute shows that in European countries 66% of teachers agree that the ICT helps on their professional development.

Concerning the efficiency of the teaching process, 66% of teachers have answered that the process is more effective when they use ICT versus 52% of teachers in other European countries which claim the same. 18% of teachers think that the efficiency of the work is the same both with using and without using ICT, and just 8% of teachers have declared that efficiency of the teaching process is worse when they use ICT.

Concerning the motivation, 70% of teachers are more motivated when they use ICT versus 7% of teachers who are less motivated when they use ICT. 19% of teachers have answered that they feel the same motivation. Taking into the consideration that concerning the ITS institute, in the European countries just 50% of teachers are more motivated and 41% have answered that the motivation is the same when they use ICT, one can conclude that in Macedonia ICT has bigger impact in motivating the teachers in their work.

The other interesting result is concerning the interactivity in the class when the ICT is used. 65% claim that the interactivity is on the bigger level when ICT is used, versus 34% of teachers by the ITS institute who claim the same. So, in Macedonia also the interactivity in class is increased. Teachers claim that they can administrate the class in more efficient way if they use ICT. This percentage in our research is 66% and 16% of teachers have answered that there is no difference in administration of lessons when using and not using ICT.

Concerning the support given by the school for using the ICT, 25% of teachers think that there is some support, 26% of teachers have answered that this support is minor and 49% think that there is no any kind of support from the school. Concerning the support from the ministry of education, 12% of teachers have declared that they have any kind of support, 46% of teachers have answered that this kind of support is minor and 42% of teachers have declared that there is no any support from the ministry of education.

Concerning the barriers and obstacles of not using the ICT in the teaching process, we have analyzed the reasons by taking percentages only from the teachers who have answered with level 1 (the smallest level) to the question if they use ICT. From this category of teachers, 65% of teachers have mentioned that the reason why they do not use the ICT in the teaching process is the missing of computers in the classrooms. This is very big percentage and is contradictory fact by the level of investment of the state for equipment of schools with computers. This means that there are probably some other problems which make the mentioned project nonfunctional. Another mentioned reason (15% of teachers are mentioning it), is that the teachers do not have confidence in using ICT. This means that the school and the ministry should take into the consideration this fact for organizing additional seminars and trainings for this category of teachers. 10% of teachers do not see the reason for using the ICT. So, there must be found the way for motivating this category of teachers. 5% of teachers think that the lesson plans don't offer possibility for implementation of ICT. There are also answers where as the reasons of not using ICT are mentioned lack of the time, the nature of the subject, etc.

Concerning the using of ICT and its impact on the subject of mathematics we have used the cross tabulation analysis and we have analyzed the significant result using the Pearson value from the so called chi-square statistics. The chi-square statistics is often used to test for the independence of two categorical variables. The null hypothesis is that the two variables are independent, and the alternative is that the variables are related. If the significance value (pearson's constant is less than 0.05, then we will reject the null hypothesis, and conclude that there is a significant dependence between the variables. Among others, we have analyzed the place of school students come (capital, other town, the village) with the level of ICT usage. We may expect students from capital and other towns to have greater access to ICT. Using cross-tabulation analysis we have confirmed this expectation. The significance p-value is 0.037. , This means that out of a hypothetical hundred samples of students, only 3.7% would fulfill the null hypothesis of independence. So, because $0.037<0.05$, we reject the null hypothesis, and conclude that there is a big dependence between the type of school and level of usage of ICT in the teaching process.

In order to analyze the impact of the ICT usage on the subject of mathematics, we have used the so called t-testing. The interpretation is that if the probability of getting two sample means at least as far apart as those observed is 5% or less, then one can conclude that the results are so unlikely under the null hypothesis that the null hypothesis is not true. That is, we reject the null hypothesis that the samples were drawn from populations with the same mean, and conclude that the samples come from populations with different means. We have used this, in order to analyze the score on the test on mathematics versus the level of using the ICT. The score on the test of mathematics was used as the dependent variable, and the level of using the ICT (measured by 1 to 5) was used as the independent variable. The obtained probability value titled Sig (2-tailed) was 0.04. This result means that there is a 4% chance of obtaining sample means at least this for apart if the null hypothesis is true. So, we reject the null hypothesis of equal means, and conclude that the students with higher value of usage of ICT tend to have different results on the math test than do students with lower value of usage of ICT. On the other hand, the t-test output for the score on the test on Albanian language, gives the result 0.847. Since this value is higher

than 0.05, we cannot reject the null hypothesis of equal means. So, we cannot say that the usage of ICT in the teaching process has the effect on the test in Albanian language.

Concerning the regression analysis, we conclude that there is a linear relationship between test score on mathematics and usage of ICT. The significant level is 0.0002. So, we reject the null hypothesis of no linear relationship. On the other hand the same significance value for the score in the test of Albanian language was 0.2. this value is bigger than 0.05. From this results one can conclude that the null hypothesis should be accepted, which means that there is no the linear relationship between the score on the test on Albanian language and the usage of ICT.

CONCLUSION

Using the results of this research one can create a clearer and detailed picture concerning the level and different categories of usage of ICT in Macedonia and the implementation of the ICT in the teaching process. From the research one can see the different results obtained from the descriptive statistics concerning the different categories. Some of the percentages obtained for different categories were compared by the percentages obtained from the ITS institution for the same categories which makes possible to make conclusions concerning the cases in the Republic of Macedonia.

Some of the interesting conclusions are as follows: The teachers which were trained on using ICT, use it in bigger level. This means that organizing different trainings and seminars from the schools and other institutions increases the level of using of ICT. Pupils who use ICT in the learning process, have bigger success in problem solving situations.

Also by using the Pearsons chi-square test, we have shown that there is a big dependence between the type of school and level of usage of ICT in the teaching process. The ICT on the villages do not have the impact in the teaching process because it is not used in the sufficient level.

By using the t-testing we have concluded that the students with higher value of usage of ICT tend to have different results on the math test than do students with lower value of usage of ICT. This means that the usage of the ICT has the direct impact on the process of learning mathematics. By the regression analysis we have shown that there is a very big linear relationship between the test scores on the subject of mathematics and the usage of the ICT in the teaching process.

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