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Analyses of Student's Achievement Depending on Math Teaching Methods

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Abstract

The paper is focused on processes of modernization of teaching mathematics in primary schools by using ICT. The empirical results from the realized research shows that the Macedonian educational system should introduced and practiced ICT for math teaching. The paper is organized on the IMRD methodology. The first part *Introduction* is given the theoretical background of the terms: math teaching, teaching methods, ICT teaching… In the next part are described the *research methodology*, and present the acquired results. The hypotheses are tested with the statistical package SPSS17. *Discussion* about the hypothesis is the third part of the paper.

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1. Introduction

In recent years, most of the developed and underdeveloped countries in the world have been paying a particular attention to the application of ICT in the educational process, by which the pupils are introduced to the way of its working and its new technologies. When talking about ICT in education, what is used most commonly is the abbreviation ITLET (Information Technology for Learning, Education and Training) or the definition of the application of the educational technology stated by AECT as "...the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources." (AECT, 2009)

In order to use ICT in class properly, new technologies should be introduced in education and the way of teaching should be modified or adjusted. The synthesis of classical programmed instruction and the traditional one (one teacher – one pupil) along with the technical and computer assisted program, has contributed to the creation of a new form of teaching called computer-assisted instruction (Computer Assisted Instruction, CAI).

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The application of the modern information technologies (information systems, multimedia, Internet) in the traditional educational processes can give significant results.

The question about the way in which the information technology can contribute to better acquisition of knowledge in mathematics offers an answer in the application of the educational software in Math classes, which optimally meets the goals set in the mathematics education. A high-quality educational software is supposed to pique pupils' interest, as well as to inspire them, make them active, and guide them. In addition, the educational software should have the following principles: adequacy, obviousness, clarity, goal orientation, exemplariness and self-initiation. The educational software, as a complete program realization of a particular educational content, should contain the components found in classical teaching: phase of motivation, problem solving phase, application phase, the phase of controlling the learning and the phase of knowledge deepening and strengthening.

The educational math software, with all the characteristic ways in which it is used, should provide to each pupil his/her own pace of working and acquiring the presented material. Besides, the need for a change of the teacher's role, identified and emphasized by Gerlach V.S.& Donald P.E. (1980, p.5), in reference with "new resources – new instructions", has also become topical.

The question is being posed: "What are the specific possibilities and potentials that the use of the computer in math teaching offers?" Which moments and aspects of teaching require the use of the computer, and which ones require traditional instruction.

According to Schneider (2002), the possibilities offered by the application of computer in math teaching are:

- Different forms of display (direct access to the various forms of display of mathematical contents, as well as easy switch from one form to another, for example from symbols to graphs, etc.);
- Experimental learning (an opportunity for the pupils to elicit new knowledge, ideas, and solution to a problem, independently, via experimenting):
- Elementarization of mathematical procedures (the use of computers has made elementary methods abandoned because of the numerous calculations required possible to perform)
- Modularity (the ability to call the commands direct, regardless of the steps in the algorithm and in the calculation procedure).

2. Methodology

In order to determine the effects of the application of ICT in math teaching a research was conducted in a primary school.

The objective of this research was to determine the existence of differences in efficiency (greater success, activity, attention) of math classes with ICT application and those with classical verbal-textual method and whether those differences were statistically significant.

The research was conducted in the seventh grade of the eight-year-primary-education school "Dimitar Vlahov" Štip, R. Macedonia, in May, 2011. Two classes of the seventh grade were selected by random, each of them with 30 pupils.

The two seventh-grade classes included in the research had approximately the same Math class grade average. One of the selected classes was a control group and the classic verbal-textual method was used with them. The other class was the experimental group with which the application of ICT in math teaching was used.

The unit "Function of Proportionality" was being taught y means of GeoGebra software, free software installed on all of the computers in the school.

Once the unit had been done, pupils from both classes were tested with the same knowledge test in order to evaluate their achievements. The results were compared and analyzed, and changes were identified.

We must point out that although the school and the classes were selected by random choice, they are not representative as a sample. Based on the research rules, the conclusions cannot be generalized about all of the schools in Republic of Macedonia.

A more detailed analysis about the achievements of the pupils who attended math classes with classic verbal-textual method and the achievements of the pupils who attended math classes with ICT application is given in our

paper *Effects of the use of the software package GeoGebra* in the unit "Function of Proportionality" in the seventh grade of the eight-year-primary-education (Pacemska S., Jakimovik S., Atanasova- Pacemska T., 2011).

In this paper an analysis of the pupils' achievements is made with reference to the way of teaching the math class.

In the research two classes of seventh grade were included, a control and an experimental group. Before the research the instruction in both classes was realized by application of the verbal-textual method and by different teachers.

3. Results and discussion

The hypothesis set is if there is a statistically significant difference between the level of pupils' achievement in the control and the level of pupils' achievement in the experimental group.

The verification of the hypothesis is made by the Pearson χ^2 test in the interest of the independence of classroom activities and the methods of task selection in checking the pupils' achievements. Analysis of the results is made in SPSS17.

Table 1. Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.315[a]	4	.989
Likelihood Ratio	.316	4	.989
Linear-by-Linear Association	.080	1	.777
N of Valid Cases	60		

a. 2 cells (20.0%) have expected count less than 5. The minimum expected count is 4.00.

The table shows that the value of Asymp. Sig is 0,989. This value indicates that before the research, there was not a statistically significant difference between the achievements of the pupils in the control group and the achievements of the pupils in the experimental group. There is a statistically significant difference if Asymp.Sig< 0, 05.

After the realization of the topic "Functions of Proportionality", pupils from both groups (the control one and the experimental one) were tested with the same knowledge test. The difference in the testing was that the pupils of the control group took their test on a sheet of paper, and the pupils of the experimental group took their test both on a sheet of paper and on the computer.

In order to determine whether the achievements of the pupils in the control group and experimental group depended on the way the math classes were given, the following hypotheses were:

H_0: There is not a statistically significant difference between the achievements of the pupils who attend math classes with ICT application and the achievements of the pupils who attend the math classes in which the classic verbal-textual method is used.

H_1: There is a statistically significant difference between the achievements of the pupils who attend math classes with ICT application and the achievements of the pupils who attend the math classes in which the classic verbal-textual method is used. To test these hypotheses we used the Pupil's t-test for repeated measurements. The knowledge test was repeated in both, the control one and the experimental one. In the control group the unit was taught in a traditional way and in the experimental group with ICT application.

Table 2. T-test statistics

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
VAR00001-VAR00002	-.36667	.49013	.08949	-.54969	-.18365	-4.097	29	.000

The analysis made in the statistical package SPSS17 indicates that Sig. (2-tailed)=0.000, t= - 4,097 и df=29.

Sig. (2-tailed) shows us the probability of making a wrong conclusion. If the value is less than 0.05, we should conclude that there is a statistically significant difference. In our case Sig. (2-tailed) = 0, which means that ***there is*** *a statistically significant difference between the achievements of the pupils and the way in which mathematics is taught*. The null hypothesis is being rejected and the following alternative one is accepted i.e.

Eta squared is calculated with the formula $\eta^2 = \frac{t^2}{t^2 + N - 1}$.

$$\eta^2 = \frac{(-4{,}097)^2}{(-4{,}097)^2 + 30 - 1} = \frac{16{,}79}{16{,}79 + 29} = \frac{16.79}{45{,}79} = 0{,}37$$

Eta squared value determines what is the difference between the results obtained. When $\eta^2 \geq 0{,}14$, it is concluded that the impact between the researched phenomena is high. We get $\eta^2 = 0{,}37$ which shows that there is a large statistical difference between the achievements of the pupils attending math classes with ICT application and the achievements of the pupils attending math classes with no ICT application.

We have confirmed the set hypothesis that the pupil's achievement depends on the way in which math classes are given.

In order to determine whether the achievement of the pupils in the experimental group depended on how the math classes were given, the following hypothesis was set:

H_0 : There is not statistically significant difference between the achievements level of the pupils who attend math classes with ICT application and when they attend math classes with no ICT application.

H_1 : There is a statistically significant difference between the achievements level of the pupils when they attend math classes with ICT application and when they attend math classes with no ICT application.

An analysis of the achievements of the pupils before the research and their achievements in the knowledge test, after being given math classes with ICT application, was being made.

The analysis made with the statistical package SPSS17 is given below.

Table 3. T-test statistics

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
VAR00001 - VAR00002	-.46667	.50742	.09264	-.65614	-.27719	-5.037	29	.000

The table shows that the value of Sig (2-tailed) is 0,000 and it is smaller than 0.05, therefore we can make a conclusion that *there is a statistically significant difference between the achievements of the pupils attending the traditional math classes and the achievements of the pupils attending math classes with ICT application*.

The size of the statistical difference is determined by ETA squared $\eta^2 = \frac{t^2}{t^2 + N - 1}$

$$\eta^2 = \frac{(-5{,}037)^2}{(-5{,}037)^2 + 30 - 1} = \frac{25{,}37}{25{,}37 + 29} = \frac{25{,}37}{54{,}37} = 0{,}47$$

The result value indicates that there is a very large statistical difference.

Resume

The use of information and computer technology gives dynamics to the process of knowledge and skills acquisition in the school subject Mathematics. Moreover, the interest in mathematics is increasing, and the usual barriers with pupils concerning the abstractness of the teaching material and the fear of failure in solving the given

task is being reduced or absent. Visualization in the process of teaching is necessary and worthy of implementation, although it "...can be challenging, frustrating, time-consuming and expensive".(Barron E. A. at al., 2006, p.4)

References

Barron E. A. at all. (2006). *Technologies for Education- A practical guide,* Westport, Connecticut, London: Libraries Unlimited

Gerlach V.S.& Donald P.E. (1980). *Teaching and media*, London: Prentice Hall

Pacemska S., Jakimovik S., Atanasova- Pacemska T., (2011). *The effects from using program package Geogebra in the thematic area "Functions, proportionality" in VII grade of eight years elementary school education.* VI Меѓународен Балкански конгрес за образование и наука "Современото општество и образованието", 30.09-1.10. 2011, Охрид

The Meanings of Educational Technology, AECT Definition and Terminology Committee document #MM4.0 June 1, 2004, Retrieved on 7th of October 2009 from: http://www.indiana.edu/~molpage/Meanings%20of%20ET_4.0.pdf

Вилотијевиќ М. (1999). *Дидактика- Организација наставе*, Београд: Завод за уџбенике и наставна средства