

# The Impact of Computer Use on the Teaching of Geometry in Grade 8

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## **ABSTRACT**

The research on the efficiency of computer-assisted learning has provided contradictory results. The objective of the current study is to clarify the impact of using computer on learning results and the motivation of the students who learn Geometry in the 8<sup>th</sup> grade. The survey was carried out among the students of the 8<sup>th</sup> grades of four schools in Estonia in school year 2004/05. In the present paper, the students' performance in the experimental (N=119) and control classes (N=174) is compared. In addition to traditional methods of teaching, computers were used in teaching Geometry in the experimental classes. In the control classes the computers were not used. According to the research carried out in the area, the application of computers has not generated better results. As for the students' attitude to the learning process, it has been noted that the application of computers has definitely improved the students' attitude to Mathematics. The students of the experimental classes were posed a question if using computers has changed their attitude to Mathematics. Forty per cent of the students were of the opinion that the use of computers has improved their attitude to Mathematics. The students find that the use of computers makes studying more interesting, easier, fun and more understandable.

## **Keywords**

Computer-assisted learning, geometry, dynamic geometry system

## **INTRODUCTION**

In Estonia computers have been used in teaching Mathematics for about 15 years. During the last 10 years they have been used more widely. According to the present Estonian curriculum it is not obligatory for teachers to use computers in teaching Mathematics. Teachers decide if and to what extent they use computers. In school year 2011-2012 a new curriculum becomes into force and the point at issue will be how much and in which topics to use the possibilities of ICT.

Previous studies in the field seem to indicate that the effect of using computers may be positive or negative or the use of computers may not affect the results at all (Khalili & Shashaani, 1994; Liao, Y.-K. 1992; Wang & Sleeman, 1993; Luik, 2004; Baki and Güveli, 2008, Pihlap, 2009). According to McCoy (1996), a large number of studies would be needed to describe and assess various possibilities of computer use across the entire Mathematics curriculum. It should be clarified, what works and what does not and what would be the best ways to use computers. The respective study aids should be examined with this viewpoint in mind.

The objective of the current study is to clarify the impact of computer use on learning results and motivation of the students who learn geometry in the 8<sup>th</sup> grade.

## **2. Method**

### **Participants**

The survey was carried out in school year 2004/05 in the 8<sup>th</sup> grades of four schools in the city and county of Tartu. Eight class groups were used as control classes where no computers were used for teaching, and six were experimental classes where teaching involved some computer use. The division of classes into control and experimental classes was based on the availability of the computer classrooms for the Mathematics lessons. Total of 293 students and 14 teachers participated in the survey. Only the tests of the students who completed both the pre- and posttests were included in data analysis. There were 174 such students in the control classes and 119 in experimental classes.

### **Materials and Procedure**

Pre-test were carried out in all classes before starting to learn Geometry. After learning the topic of Geometry, all students had to take a post-test to monitor their learning results.

In all classes, the topic of geometry was covered in 50 lessons. In the experimental classes 7 lessons (out of 50) took place in the computer class and the rest were traditional. The goal of this survey was to use computers in a similar manner as they are normally used in Estonian schools when teaching Geometry. The teachers do not have the opportunity to use the computer class always when they would like to. However, in many schools there is a possibility to use it once a week. Khalili & Shashaani (1994) find that the use of computers in education is more efficient if computers are used as an addition to and not as a substitute of traditional teaching. Therefore, computers were used as an addition to traditional methods in this study as well. Only traditional lessons took place in the control classes, without any visits to the computer classroom. All experimental classes used the same worksheets and software applications. The teaching materials (worksheets for exploratory learning using the programme of dynamic geometrics called GeomeTricks, various tests, MS Excel worksheets) for classes that were held in computer class were given to teachers in CD-s. Teachers decided in which lessons they used these study materials.

In addition to the post-test, the students of both experimental and control classes filled out a questionnaire on their opinions about studying Geometry. The students of experimental classes also filled out a questionnaire where they had to answer questions about the lessons in the computer class using a five-point Lickert scale. The students had also an opportunity to explain some of the responses.

## **3. RESULTS AND DISCUSSION**

A t-test was made to compare the average scores of experimental and control classes. The average score in difference of the post- and pre-test in the experimental group was 13 while the control group scored 14.8 (Table 1). The control group scored slightly higher in difference of post- and pre-tests. As the differences of the average scores are not statistically significant ( $p > 0.05$ ), one could not claim that the learning

results of the control group were better than those of the students who used computers. Consequently, the use of computers in the teaching of geometry did not make much difference for the results of learning.

Type of test	Type of group	N	Average score	Standard deviation	p
Difference: posttest-pretest (max 18p)	Control class	174	14.8	11.8	0.2
	Exper. class	119	13.0	10.6	

Table 1. Learning Results

The students were asked to assess the difficulty of Geometry. The students could give their answers on a scale where 1 meant that Mathematics is difficult and 5 meant that it is easy. The experimental classes gave an average assessment of 3.91 and control classes 3.66 (Table 2). The students were asked to assess how interesting was studying Geometry (1 meant that Mathematics is dull and 5 meant that it is interesting). The control classes gave an average assessment of 3.46 while the experimental classes gave 3.74. When asked “Did you like studying Geometry?” the experimental and control classes responded with average scores 3.85 and 3.55 respectively. All differences of the average scores are statistically significant ( $p < 0.05$ ). The students who used computers had enjoyed studying Geometry more than the students of the control classes. They found Geometry easier and more interesting than the students of the control classes.

Question	After studying geometry				
	Type of group	N	Mean	Standard deviation	p
Studying geometry is difficult (1)... ..easy (5)	Control class	157	3.66	0.95	0.03
	Experimental class	90	3.91	0.86	
Studying geometry is dull (1) ... interesting (5)	Control class	158	3.46	0.98	0.02
	Experimental class	91	3.74	0.88	
Did you like learn geometry? no (1)... yes(2)	Control class	155	3.55	1.44	0.03
	Experimental class	88	3.85	0.99	

Table 2. Student’s opinion about learning Geometrics

The students of experimental classes also filled out a questionnaire about the lessons in the computer classroom using a five-point Lickert scale. A total of 107 students filled out the questionnaire. When asked to evaluate the lessons in the computer classroom, 57 % of the students said that the computer helped them to understand what they were learning and they would like to use computers for learning in the future as well; 38 % of the students claimed that the computer makes no difference and 4 % (five students) reported that the computer made understanding more difficult for them and they would not like to use the computer in the future. One of the

aforementioned five students admitted that he was not very familiar with computers and often encountered problems he could not solve. Four out of five found their knowledge on using computers to be good. One student did not like using computer as his eyes tired fast and the class room was too dry and hot for him.

Students were asked to explain what they liked about the classes that took place in computer class-rooms. It was mentioned that they liked

- (1) teamwork: *liked teamwork with desk-mate; liked to discuss with a partner how to solve a question; liked work spirit and willingness to study;*
- (2) research and experimentation: *liked broader opportunity to experiment; more opportunities were noticed and students were convinced that things are true and valid; it was possible to put everything to the test;*
- (3) learning programmes: *programmes were good; it was possible to test one's knowledge; system checked the answers and it was known immediately if the answers were correct; liked the programme of geometrics (GeomeTricks); it was easier to draw figures, they looked nicer, drawing took less time and it was more fun; it was mentioned that a student generally liked techniques and to use it for different purposes and that it was always exciting.*

Also the students were asked to write what they found disturbing in classes held in computer class-rooms. It was mentioned that (1) technical problems: *computers were slow; teachers could not help all the students fast enough when assistance was needed;* (2) teamwork or its absence: *when I was alone there was nobody to discuss a problem; it was disturbing when two students shared one computer;* (3) complicated worksheet: *worksheets were very difficult;* (4) discomfort concerning the class-room: *it was airless, the chairs could be more comfortable.*

The students were also asked whether the lessons in the computer class had changed their attitude towards Maths. 87 students (of 107) answered this question whereby 36 students (34 %) answered 'yes' while 51 (48 %) answered 'no'. The students were also asked to explain their answer to this question. It turned out that one student's attitude had become more negative. She explained: *I do not specially like performing tasks with computers, thus I did not like math classes where computers were used.*

The attitude of 35 (32,7 %) students had become more positive. They noted that before they did not specially or at all like Maths, but later they had started to like it due to going to computer class-rooms: *it makes a lesson more interesting and they were always looking forward for the next lesson.*

Students found it more *comfortable* and *easier* to solve tasks in computer class-rooms. It was stressed that it was easier to understand Mathematics in lessons taught in computer class-rooms and it had changed student's attitude to Maths. Students liked that they were *able to try everything out*. One student wrote: *due to using computer I have understood that it is very much possible to know and understand Mathematics.*

The assessment of the use of computers in Maths by the students of the experimental classes indicates that application of computers enables to increase the interest of the students in Mathematics. Similar observations were made in earlier research (Kulik & Kulik, 1987; Luik, 2004; Pihlap, 2009; Baki & Güveli, 2008).

In conclusion, the current study indicates that in general the use of computers had neither positive nor negative impact on the results of learning in the teaching of Geometry in the 8<sup>th</sup> grade. The students find that the use of computers makes studying more interesting, easier, more fun and understandable. 32.7 % of the students report that their attitude towards Maths has improved after using computers in the lessons.

The outcome of the present research might encourage teachers to use the possibilities of ICT in Maths lessons and thereby to make their students to take more interest in learning Mathematics.

## References

- Baki, A., Güveli, E. (2008). Evaluation of a web based mathematics teaching material on the subject of functions. *Computers & Education*, 51(2), 854-863.
- Khalili, A. & Shashaani, L. (1994). The effectiveness of computer applications: a meta-analysis. *Journal of Research on Computing in Education*, 27(1), 48-61.
- Liao, Y.-K. (1992). Effect of computer-assisted instruction on cognitive outcomes: A meta-analysis. *Education*, 24(3), 367-379.
- Luik, P. (2004). Drillprogrammide efektiivsuse faktorid. *Tiigrihüppe Sihtasutuse uuringute kogumik*, 17-32.
- McCoy, L.P. (1996). Computer-based mathematics learning. *Journal of Research on Computing in Education*, 28(4), 438-460.
- Pihlap, Sirje (2009). The Impact of Computer Use on the Teaching of Functions in Grade 7. In: *Proceedings of the 9th International Conference on Tecnology in Mathematics Teaching: The Ninth International Comference on Tecnology in Mathematics Teaching (ICTMT9); University of Metz, France; July 6-9, 2009.* (Eds.) Bardini, C.; Fortin, P.; Oldknow, A.; Vagost, D., 2009, 1 - 4.
- Sadolin, V. (II). GeomeTricks. Version 2.36. Computer software.