Teaching Mathematics via Computer.  
‘The case of Trigonometry’.  

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Learner thinks, teacher guides, technology supports. (Abtar, 2000).

I am currently employed as a teacher of Mathematics at the Paralimni Technical High School by the Cyprus government (Ministry of Education and Culture). The school is located in Paralimni village and our region is the rural community of Kokkinochoria “Red soiled villages”. We have about 120 students and 20 staff. The mathematics faculty has only one staff, me.

The reasons which have dictated this research were the need to study the effectiveness of the computer as a teaching instrument, as well as the lack of researches in Cyprus as far as the subject of Trigonometry in Technical Schools is concerned.

The project has given me the knowledge of research design. I have learned and become more capable of working on research projects and gained valuable knowledge out of it. Through the whole procedure, I feel that I have become a more complete instructor. I have improved my academic knowledge in teaching Mathematics and my efficiency in classroom management. I have gained knowledge that can be used both in my work environment and the daily routines too. It has also helped me to reflect on my students, attitude and thus understand my students better.

**Aims and Objectives of my project**

The research aims to investigate the effectiveness of using the computer as a teaching aid in Trigonometry in the first year students of the Paralimni Technical High school.

The objectives are to identify the following:

1. Whether the performance of the students that have been taught trigonometry via the computer is higher than the performance of students who have been taught in the traditional way.
2. Identify whether boys’ and girls’ scores on academic tests were the same.
3. Identify the connection between the teaching method and the students’ gender.
4. Identify the impact of the use of a computer on students’ attitudes towards mathematics.

**Deskwork** is spent on literature research and data analysis.

**Fieldwork** involves an experiment that took place in the computer laboratory of the school.

In the experiment group there was a combination of teaching media such as the computer, the video projector and the board. The teaching of the control group was effected mainly through the whiteboard while as an approach I used the group work. **Experimental designs** are especially useful in addressing evaluation questions about the effectiveness and the impact of programmes. Experimental designs increase
researchers’ confidence, that observed outcomes are the result of a given programme or innovation instead of a function of extraneous variables or events.

**Data collection techniques**

**Documents:**
- They provided me with the first group of data which occurred from studying the literature.
- Through the documentary study, I gathered information and used it in order to identify the learning of mathematics via computer.

A pre-test which included exercises on basic mathematic knowledge was conducted. This test was given at the beginning of the school year in order to determine the norms of the incoming students in Technical schools in Cyprus. A post-test was performed as well, which assessed the trigonometry concepts that the two groups had been taught.

A questionnaire of attitudes. The questionnaire included 35 statements and was taken by a blending of statements from the questionnaires of attitudes of the:

a) Assessment of Performance Unit (A. P. U)
b) Research on the Geometry students’ attitudes (Karagiorgos, 2002).
c) Research on the students’ attitudes (Filippou and Christou 2003).

**Research sample**

<table>
<thead>
<tr>
<th>Experimental group</th>
<th>Control group</th>
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<tbody>
<tr>
<td>Boys</td>
<td>Girls</td>
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<tr>
<td>14</td>
<td>12</td>
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**Inside Researcher**
My role as a Mathematics instructor in conjunction to the fact that I am producing material to be used for the lessons I teach, played a significant role in the way I conducted the research and the way I wrote the outcome of my work. I, as an instructor, am adequately familiar with the curriculum and this helped me set the aims and the objectives of my study. Through the research, specific methods were followed in order to fulfil these aims and objectives.

**Data analysis**
For the data analysis the SPSS was used. SPSS enabled me to input raw data, to modify and reorganise them once they had been inputted and to carry a wide range of statistical and multivariate analyses.
Project Findings
Pre-test analysis showed the equivalence of the two groups (experimental and control group) in respect of the students’ performance in the general Mathematical knowledge. There was no connection between the gender and the groups.

Pre-test and post-test analysis
A pre and post-test comparison have shown that the experiment, as well as the control group, has displayed a progress. The experiment group had better results than the control group. Since the experiment group had better results than the control group, there is a possibility that the use of the computer as an instructive means in Mathematics will help the improvement in students' proficiency. Probably by using the computer students applied their ICT skills to increase their knowledge and understanding of Trigonometry.

The software might also provide them the opportunity to acquire and practise geometrical skills. Opportunities occur when student create, analyse and interpret dynamic spatial images; make and test conjectures about geometrical relationships that they can manipulate, record and present the results of their investigations.

It is possible that this improvement was due to the fact that students have been “worn out to be instructed in the traditional way” (Simeou et all, 2004) and this way the use of the computer, as a new instructive means roused interest. The fact that the use of the computer was combined with traditional teaching is possible that it contributed in succeeding the above, as Edwards claims (1974).

Girls' progress was greater than boys'. Probably girls had more confidence and sense of independence in mathematics and stopped viewing math as a male domain as Fennema (1985) argues. Tiedemann (2000) believed that boys could increase their success through additional effort, and that girls used more of their functional capacity for mathematics than boys do. Boys’ failure might be attributed to lack of effort.

Questionnaire analysis
The experiment group students’ attitude, regarding their satisfaction towards Mathematics, was increased in relation to the control group, which remained the same. The experiment group students’ attitude regarding the usefulness of Mathematics was increased in relation to the control group, which remained the same.

Recommendation
I strongly recommend to the Ministry of Education in Cyprus (my employer) to use the outcome of this project as an instructive model that is intended to permeate teaching and learning Mathematics. In particular, I wish to see the potential of ICT realised in supporting the teaching and learning of geometry. There is already software available, such as for dynamic geometry, Calculus, Statistic, Computer Assisted Instruction (CAI), but its use is not widespread. Many schools do not have licences for the software. There is also a need for the development of additional software, such as to support work in 3-dimensions. I would like to see the funding to schools for ICT being used more effectively to support the Mathematics curriculum.

The most significant contribution to improvements in Mathematics teaching will be made by the development of good models of pedagogy, supported by carefully designed activities and resources, which are disseminated effectively and coherently to and by teachers. I also recommend to my colleagues, the Mathematics Instructors,
to go beyond these interrelated mathematical processes and select instructional strategies appropriate for their students:

1. Positive attitude
2. Connections
3. Problem solving
4. Reasoning
5. Visualisation
6. Relationships
7. Shape
8. Technology

Reference


**Bibliography**

American education research association. 
http://www.aera.net/

An introduction to Trigonometry.  
www.ping.be/~ping1339/gonio.htm


Assessment in Education 
http://www.carfax.co.uk/

CEO Forum on Education and Technology. (2001, June). The CEO Forum school technology and readiness report: Key building blocks for student achievement in the

British educational communications and technology agents. http://www.becta.org.uk/

Classroom Assessment http://fcit.usf.edu/assessment/index.html

Dave's short course in Trigonometry. www.aleph0.clarku.edu/~djoyce/java/trig/.

Ethics of Research Involving Human Participants http://www.has.vcu.edu/psy/faculty/fors/ethics.htm

Ethics resources center http://www.ethics.org/


How Students Learn Vs How We Teach. honolulu.hawaii.edu/intranet/committees/ FacDevCom/guidebk/teachtip/teachtip.htm

International Journal of Instructional Technology & Distance Learning http://www.itdl.org/index.htm

Mathematical Association of America http://www.maa.org/


Practical assessment research and evaluation http://pareonline.net/Home.htm

Resources to help you learn and use SPSS. UCLA academic technology services. http://www.ats.ucla.edu/stat/spss/

Statistics and Experimental Design http://www.colorado.edu/che/CLASSES/chen5838/statisticsanddesign.html
STATS - S'Teve's Attempt to Teach Statistics
http://www.childrens-mercy.org/stats/

Teaching Tips.
www.teachingtips.com/

The Geometer's Sketchpad resource centre.
http://www.keypress.com/sketchpad/

The Data and Story Library
http://lib.stat.cmu.edu/DASL/DataArchive.html


Trigonometry
www.acts.tinet.ie/trigonometry_645.html