

Application of Computer Aided Mathematics Teaching in a Secondary School

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Abstract

This is a case study that examines the effect of using presentations developed by teacher in addition to using commercially produced educational software CD-ROM in Audio-Visual Room/Computer Laboratory after classroom teaching, on students' academic achievement, as a method of Teaching Mathematics compared with only classroom teaching or after classroom teaching, using commercially produced educational software CD-ROM in Audio-Visual Room/Computer Laboratory.

Introduction

Developments in technology have made changes on educational environments and exerted new approaches to applications of learning-teaching attitudes. Educational process needs more than traditional instructor and student-teacher roles become changing eventually. Student becomes learner and his/her role is going to be active thinker rather than passive listener, while teacher becomes guide to lead learner to relevant information, define needs and expectations of students, then help them to find and use knowledge/information.

Research Question

The survey question is: "While teaching Trigonometry subject in Mathematics lesson, does Computer Aided Teaching (CAT) have any effect on students' academic achievement?"

In order to find answer to the question, students' levels of academic achievements according to their sections were compared: only classroom teaching, using commercially produced educational software CD-ROMs in Audio-Visual Room in addition to classroom teaching or using PP presentations prepared by teacher in addition to using commercially produced educational software CD-ROMs in Audio-Visual Room after classroom teaching.

Aim of the Research

Aim of the study is to identify the effects of Computer Aided Teaching (CAT) by means of instructional methods applied in 3 different sections at the same level (Lycee II) students. In order to reach this aim, these three questions have been asked given below:

1. What was the level of academic achievement of the students that have been given only classroom teaching ?
2. What was the level of academic achievement of the students that have been taught by using commercially produced educational software CD-ROMs in Audio-Visual Room/Computer Laboratory in addition to classroom teaching ?
3. What was the level of academic achievement of the students that have been taught by presentations developed by teacher in addition to using commercially produced educational software CD-ROMs in Audio-Visual Room/Computer Laboratory after classroom teaching?

Assumptions

In this study;

1. Students were from normally distributed 3 different sections.
2. Students were accepted that did not have any knowledge about Trigonometry.
3. All three sections were instructed by the same teacher.

Limitations

This study is limited due to;

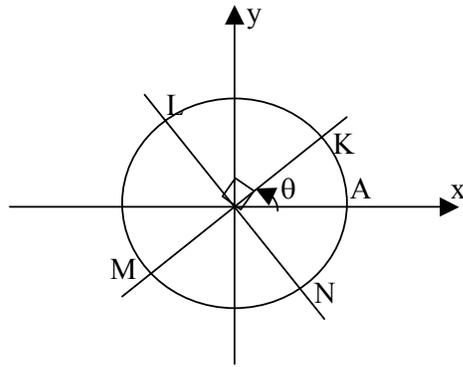
1. The academic year of 2001-2002.
2. 78 Lycee-II students were from 3 different sections of The Turkish Naval Petty-Officer Prep. School.
3. The subject studied on this research is Unit Circle/Trigonometry/Mathematics lesson.

Method Used in Research

It is a survey analysis that has been made at NPO School. During the research, all of the students were given lectures in classroom, additionally one of the sections were given CAT with commercially produced softwares and the other section was given teaching materials that was prepared by teacher.

In order to identify the effects of different methods used in mathematics teaching, 78 students have been taken from a the school who had been classified homogenously into three groups. The teacher who developed and used these presentations is a subject-matter expert, acts as an instructional designer.

At the end of the lectures, all students were given a unique (essay) examination. The examination contained 5 questions that each was of 20 points out of 100. One of these questions (4 th question) was the one that students needed to use and interprate Unit Circle.



Q-4: On the Unit Circle shown left, $[KM] \perp [LN]$ (perpendicular lines), angle of arc AK is given that $\theta = \pi/6$ radian. According to given angle θ ;

- Find coordinates of the points K,L,M,N with component over x and y axis.
- Find the angles of the arcs of AK, AL, AM, AN.

Analysing The Case

Turkish Naval Petty-Officer (NPO) Preparatory School is a 3 year vocational highschool degree boarding school. Candidates for nomination have been selected by an entrance examination and checkup to get a number of 210 students each year. When they are graduated, they go to a Classification School for a one-year of experience according to their branches and then become sergeants and ready to work for Tukish Navy as shipman. As they work, they need knowledge of Trigonometry and applications according to their branches.

Computer Aided Education has been accomplished at NPO School since 1995 in addition to classroom teaching ; opened 2 Audio-Visual Rooms (a room furnished with 1 multimedia computer and 1 projection device and chairs). Computer Aided Mathematics Teaching has also been taken part by using commercially produced educational softwares (Akademedi Maths 1-2-3 CD-ROM's).

Table-1: CAT Time Periods During a Week at The Turkish NPO Prep. School

Grade	Number of Students	L. Hours Per Week	CAT Application Time	Duration	Location
Lycee I	210	4	3 rd Hour	40 Min.	A-V Room
Lycee II	190	4	3 rd Hour	40 Min.	A-V Room
Lycee III	190	3	2 nd Hour	40 Min.	A-V Room

When these educational softwares were not able to accomplish desired teaching aims defined in curriculum, we as teachers needed to prepare teaching materials by using Microsoft Power Point slides to contribute to educational environment.

Interpretations

As istructing Trigonometry subject in Mathematics, understanding and using Unit Circle (UC) has a great importance. On a coordinate plane, any point on UC has x and y components over x-xis and y-axis. Each one of these components has a length that represents the point on UC with a radius $r = 1$ of UC over axes as projection. Radius $r=1$ of UC, lengths on x-axis and y-axis compose a righth triangle. On this right triangle with two acute angles, trigonometric ratios can be calculated (Cosine, Sine, Tangent, Cotangent, Secant, Cosecant). Coordinates of the point on UC will be so taht; length on x-axis will be $\cos \theta$ and length on y-axis will be $\sin \theta$ and then resultantly the other ratios also...

At the end of the lectures, all students were given a unique (essay) examination that contained 5 questions and each of them worth 20 points out of 100. Grades of the 4 th question according to their sections was given in Table-2 below.

Table 2: Results of the 4 th question

SECTION	AVERAGE POINT OUT 20	%	% DIFFERENCE W.R.T MINIMUM
2/A	14,1	70,5	+ 15,5
2/B	14,7	73,5	+ 18,5
2/G	11	55	0

Results of question applied immediately after the study, have shown that student from the first group were % 18,5 more successful than the second group and % 15,5 than the third group. Then it can be said that, Computer Aided Mathematics Teaching has a positive effect on students` levels of academic achievement.

Results and Discussions

Results

1. Computer Aided Mathematics Teaching, in addition to classroom teaching, can give a better learning environment by means of:
 - a. Students to understand abstract concepts than only classical classroom teaching even if in computer laboratory or Audio-Visual Room.
 - b. Teachers so that provokes the potential and provides a better educational experience.
2. In addition to existing educational softwares, presantations prepared by teacher with MS PP slides, would be beneficial.

Discussion Proposals

1. While teaching Trigonometry in a Mathematics class, it is important to understand the use of Unit Circle for finding trigonometric ratios and calculating Sine or Cosine of an angle. In order to show unit circle and help students imagine it, drawing on blackboard and demonstrating on a Power Point slide would be easier to understand it for them.
2. Technology supprots both learner and teacher no matter WHERE they are or no matter WHO they are or WHEN. Information technologies give us (for both student or teacher) oppportunity to be independent of PLACE, PERSON and TIME.
3. Under these circumstances, teacher is going to be a person who defines students` characteristics and desing how to give relevant knowledge so that students will be able to learn that needed. As a result, the teacher who can make instructional desing on his/her own subject matter expert area while taking into consideration students` characteristics, will certainly cause to create learners.
4. Learning how to use Unit Circle, is better than memorizing equations and formulas.
5. If teachers would have known basic strategies of preparing instructional materials on PC, that would be more beneficial for students` achievements, as developing presentations in order to find an answer to the question: ‘How would students learn subjects easier mentioned in the curriculum?’
6. Computer Aided/Assisted Teaching (CAT) can be considered as a necessary and supportive activity to classroom teaching. In order to create better educational environments, efficient and effective quality educational softwares (or coursewares) are needed. Then, crucial questions comes as fallowing about roles and responsibilities for CAT.
 - What are the roles and responsibilities of a teacher that takes place in CAT ?
 - What should teachers do in order to apply CAT?
 - How do teachers use teaching materials/educational softwares?
 - If there is no teaching materials/educational softwares, what should they do ?
 - How to design, develop and implement teaching materials/educational softwares ?

We as teachers need to find answers to all of these and other questions may come over, by new studies.

As a last word, I`d like to say that:

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

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