# The Effect of Course-Ware on Students 'Math Educational Achievement: a case study of Mathematics Iranian Students studying in University of Mazandaran- Iran

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**ABSTRACT:** *The aim of this project is to study the effect of math course-ware on students' educational achievement and motivation as a method which has applied educational technology in education. The subject samples of this study include 52 freshmen studying in math undergraduate in Mazandaran Teachers' university - Iran. The samples were divided into experimental and control groups by simple random method. Then pretest was held for both groups. The experimental group were taught with math course-ware and the control group were experienced the traditional method by the same professor and educational book simultaneously. Educational achievement posttest was applied for both groups. The results of data-Manova test showed the significant difference of scores of two groups and the effect of math course-ware on students' educational achievement in the lesson; public mathematics (1).*
**Keywords:** *course-ware, math achievement, teaching and learning, technology.*

## I.    INTRODUCTION

Today both science and technology are developing fast and these kinds of developments can be observed in all of our**aspects of lives** clearly. Fast and surprising expansion of new technologies evolved many **aspects of our lives** such as verities which are made in social communication, economic and trade. Universities cannot prepare persons to enter such situationsby old styles and must chose such an educational style in universities in proportion to needs that students will face the situation and external environment.

Meanwhile, to accumulate a bulk of information in students' minds is not the main goal of teaching and learning like past, but to motivate curiosity, to activate learning, grow creativity and thinking skills, to acquire life skills, to boost individual study habits and self-direction of students are the goals. "In the past, learners were considered as pots which were filled with information based on realities. Teachers were information distributors and were supposed to learn pre- fabricated materials. Educated person was a person whom many things had been read to,based on realities in several aspects. By information explosion and its speed and extensive availability, today learners need to grow problem solving skills more than ever. Today, educated person is a person who knows how to achieve information and evaluate and use them efficiently in trade and applying proper knowledge." [1]

## II.    THEORETICAL BASES

### 2.1. Psychological schools

Psychological schools' view like behaviorism, cognitivism orientation and structuralism affect the development of interactive educational methods and the use of interactive multimedia. In behaviorism school, Skinner believed in this kind of education and took steps in order to introduce it. "Behaviorism scientists especially Skinner has known as pioneers of using educational machines that are indeed the bases of educational systems based on computer today. Skinner believed that to utilize computer programming accurately,would lead to a good teaching strategy." [2]

Gonie [3] stated according to his multiple intelligence theory that students don't have a general learning capacity but they have multiple learning capacities. It means learning styles are different for learners, and these differences should be considered in teaching.ThereforeGonie's view is known as strategy in order to design multimedia learning environment.

The cognitivists believed in children's cognitive growth phases and their knowledge formation through interaction and active involving in learning environment. Regarding that computer as a multimedia can represent knowledge in different ways and interact with students, this point was in consistent with the cognitivists' oriented theories.

Moreover, structuralism theory had much effect on interactive educational growth and development and the use of interactive multimedia. According to this theory, one acts and interacts permanently to make his/her cognitive structure. One has choices and should choose from among different options and goals and they should pick out them regarding their comprehensive needs and agreements. In such a case, rigid learning

environment should not be organized previously but they should rather be adopted on the basis of their authority." [4]

**2.2. Senses role**

We can understand the value of computer using by studying senses role in learning. Psychologists andtrainers believe that persons have different styles of learning. Someone learns better through hearing and someone else acquires through watching or others through reading and so on. The primary goal of educational technology is better and deeper learning.One way to achieve this goal is to use **senses** completely. The results show that different senses do not play the same role in learning. [2]

Therefore, an accurate and efficient teaching should provide an environment that students with different learning styles can use it. Computers regarding their multimedia ability can be effective in order to provide such **an** environment. Computers can represent information by symbols, image, voice and writing and even by dynamic pictures which cause comprehensive senses contact in learning and each student with each learning style can use the classroom materials efficiently.

The role of senses is as follows:
- ✓ 75 percent learning through using sight sense
- ✓ 13 percent learning through using hearing sense
- ✓ 6 percent learning through using touch sense
- ✓ 3 percent learning through using smell sense
- ✓ 3 percent learning through using taste sense [5]
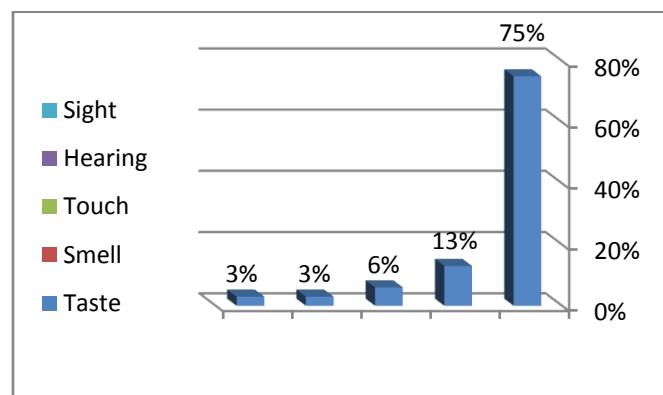
This information shows in figure 1.



**Figure1.different senses learning percentage**

Bishop (1989) emphasizes the value of visual images in all aspects of mathematics class and also Tall (1993) believes that computer is a rich source of visual and computational images which makes the search of mathematical concepts possible. [14]

## III.     COMPUTER AND MATH EDUCATION

These days math classes are boring and unattractive for students. "Some researches show that in a big math class, by speech method, indeed only 20 percent of students can use the class and often they are the best students. In addition, other 80 percent act as fast writers that take notes madly and without thinking. A few numbers ask questions or have direct relationship with the teacher. Often even they have an opportunity to ask questions, whereas they feel shy to do so." [6]

The reasons of students' educational failure; unwillingness, fear and stress are:

1. The abstract nature of mathematical concepts which is attempted to transfer to students as they are.
2. New mathematical concepts much depend on students' previous knowledge and when learning is accurate, the learners require prerequisites for a new lesson.
3. Everybody's learning speed is different from others.
4. Every student's learning style is different from other students.
5. Math teaching is not in harmony with development and technology which exists in math zone.

The above mentioned factors are paid less attention in popular methods in our math classes and usually teaching is done without paying attention to learners' learning speed, learning style, technology application and prerequisites.

Before computer emerges, a popular learning philosophy was an educational triangle among students, teachers and mathematics.This relationship is seen in figure 2 below. [15]
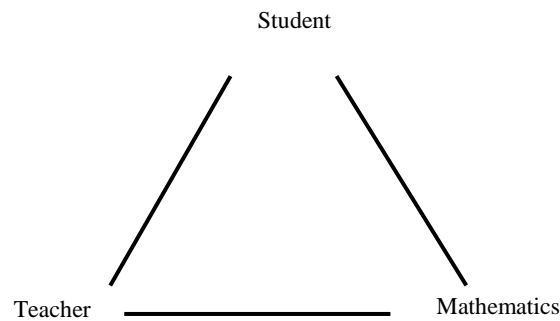


**figure2. Educational triangle**

As it is seen, there are three elements in math teaching and learning and accurate relationship among these elements which is known as a reason for better math teaching and learning, regarding the remarkable and quick development of computer technology and computer software. Tall believes [15] that four important elements affect learning situation of an educational field. They are presented as follows:
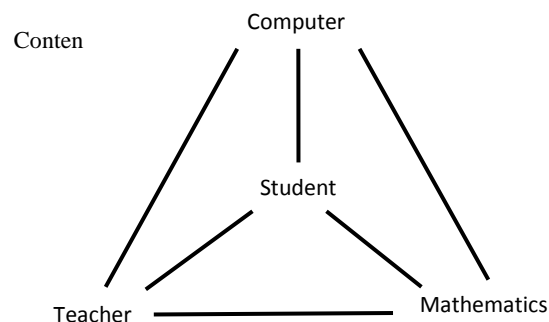


**Figure3.educational tetragon**

Hess and Tenezakis [7] state that "teaching with computer motivates students through providing immediate feedback, individual attention, attractive visual images and an environment for playing to learn by new methods that traditional method cannot cope with them. Indeed, often work with computer motivates in a way that losing their turn to work with computer is a punishment for them and to have more time to work with computer is a reinforcement to them."

Therefore, to use new technologies in math teaching is inevitable and professors should use these technologies,especially computer technology, in their teaching as far as possible. "As you don not tolerate a generation of your students, several generations of them fall behind as time goes on." [8]

In this kind of teaching, the professor uses computer or its software and accessories as an educational tool to teach better. Therefore learners should pay much attention to use computers as' a learningessence' to which professors play their important roles in this enterprise. Mito [5] states: "technology does not change teaching and learning spontaneously and directly, but it is an important element and issue that indicates us how to use technology in teaching."

National Council of Teachers of Mathematics (NCTM) [16] know computer as a primary tool for math teaching , learning and practicing and mention some advantages to it:

1 To make the creation of visual images from mathematical ideas possible.

2 To organize and analyze data easily and to calculate accurately and efficiently.

3 These tools conduct and support students to do their researches in different mathematic areas such as geometry, algebra, measuring and figures.

4 Students can concentrate on decision making, deliberate reaction, argument and problem solving.

5 Students can understand mathematic deeper by using technology properly.

# IV. COURSE-WARE

Course-ware is an educational tool which provides representation and availability to educational CD or Internet besides teachers' teaching. In this system, professors and teachers can manage the design of their course, pamphlets, class slides, exercises and projects in an integrated system and give it to students. "Course-wares are structured as educational materials that use software. These kinds of software are more popular in the U.S. than everywhere. The reason of this issue may be the related costs." [9]

Then course-ware is a kind of multimedia software that has all advantages and disadvantages of teaching with computer. "Self-instruction feature of course-ware reinforce students to have the most effective way and method to master primary concepts. Students who learn fast learn basic concepts, rules and or principles very quickly through course-ware. Having learnt slowly, the learners would have problem with learning, thus they review the program especially several times in order to understand the subject well and accurately." [10]

The idiom' course-ware' is known by [11] as explanation for materials which designsespecially by using teaching machine and it includes five primary components. They are presented in here:

- A group of teaching strategies
- Teaching materials and content
- Maintenance and representation media of something mentioned above
- Evaluation
- Reform according to evaluation

He divided course-ware according to three ways of teaching subject, skill and strategy into: According to;

1. Teaching subject
2. Teaching skill
3. Teaching strategy

Primary strategies on which course-ware is designed according to them are
a)Self-instruction course-ware (material representation)
b) Ask and answer course-ware (practice and repeat)
c) Simulation course-ware
d) Educational course-ware
e) All-purpose course-ware

# V. METHODOLOGY

Statistical sample of this research includes male math freshmen undergraduate students in Mzandaran teachers' university. They were related to higher education centers where a 52 –person samples including two classes of the lesson of public mathematics (1), one as an experimental group and the other as control group that were selected randomly. This plan consisted on two groups-- an experimental group to whom the independent variable was presented to them, and a control groupwhom theindependent variables was applied to (table 1).

Table 1. Half experimental plan

|  | pretest | Independent variable | Post test |
|---|---|---|---|
| Experiment group | $T_1$ | X | $T_2$ |
| Control group | $T_1$ | -- | $T_2$ |

Control group was taught by traditional method but experimental group experienced the independent variable research which being taught based on the course-ware application. Data collected from a statistical tool realized educational achievement test. Educational achievement test was held for both groups before and after applying independent variables, and at the end, research findings were analyzed and.

# VI. RESEARCH HYPOTHESIS

There is a difference between students who are taught by a method based on educational **course-ware** and those who are taught by traditional method regarding math educational achievement.

# VII.    DESIGN

In this research, in order to collect the data,recognized educational achievement test was used to evaluate student'seducational achievement and his/her mastering of research goals: two-dimension goal-content table from; the section of derivative concepts and its application. This test was designed, revised and finally confirmed by professors, experts and teachers in the field,  in a way that it measures knowledge and subject skills and questions skills for mathematics educational goals (**mathematical modeling, hypothesizing, argument and problem solving**). Also, to use technology in experimental group, a specialized course-ware of derivative was applied that wasmulti-purpose software.

### Validity and Reliability of educational achievement test

In this research, content validity was used in order to estimate the validity of recognized educational achievement test (pretest and posttest).
In order to measure the reliability and validity of recognized educational achievement test (pretest and posttest), the Kronbach Alpha was employed. Kronbach Alpha ofeducational achievement testis shown in table 2.

**Table 2**.Kronbach Alpha results:

| Educational achievement test | Question number | Alpha coefficient |
|---|---|---|
| pretests | 15 | 0.802 |
| Post test | 12 | 0.711 |

# VIII.    RESEARCH FINDINGS

## 9.1. Descriptive findings

A summary of descriptive statistic indices of math educational achievement which are measured in two groups; experimental and control groups in pretest that is shown in table 3.

**Table 3.** A Summary of descriptive statistic indices of math educational achievement

| Group | numbers | average | Standard deviation | minimum | maximum |
|---|---|---|---|---|---|
| experiment | 26 | 6.74 | 2.56 | 0.25 | 10.5 |
| control | 26 | 5.97 | 2.88 | 0 | 11 |

In figure 4, regarding the information presented in table 3, the average scores ofmath educational achievement test of experimental and control groups in pretest is shown as:
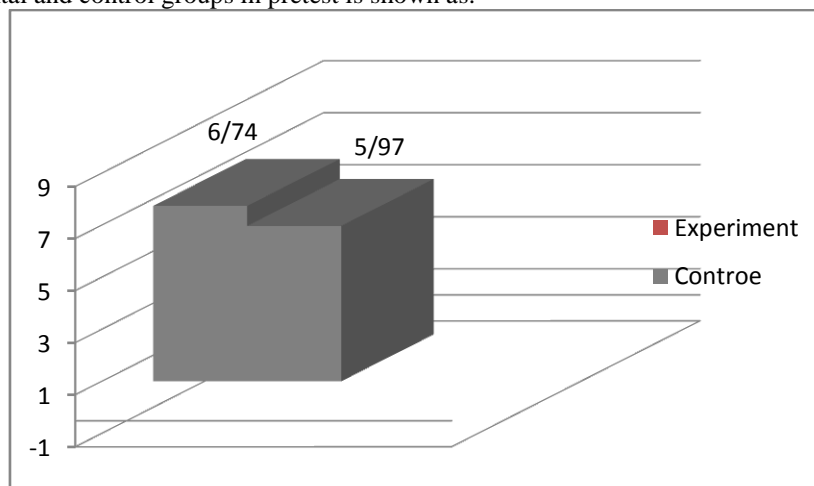


Figure4.The average of pretest scores of two groups

A summary ofmath educational achievement variables which was measured in the two groups, experimental and control groups in posttest is shown in table 4.

**Table 4**. ASummary of descriptive statistic indicesof math educational achievement variable in post test

| Group | numbers | average | Standard deviation | minimum | maximum |
|---|---|---|---|---|---|
| experiment | 26 | 9.26 | 3.44 | 3.5 | 16.25 |
| control | 26 | 5.88 | 3.34 | 1.25 | 12 |

**In figure 5**, the average scores of math educational achievement of two groups in Posttest is observed below.
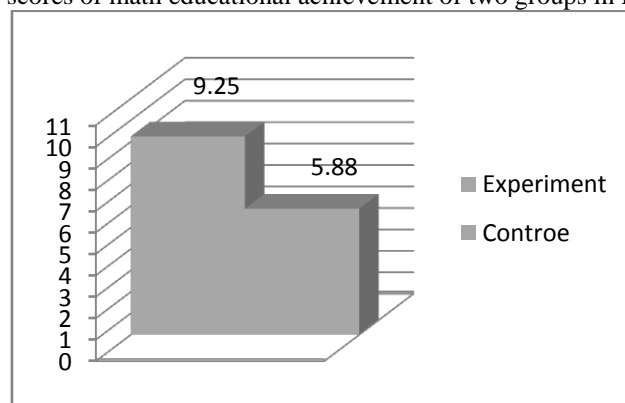


figure5. The average of post test scores of two groups

### 9.2. Results and Discussion

In order to study the significance of educational achievement of two groups, experimental and control groups in the test, Manova variance analysis was applied. The results of variance are shown in table 5.

**Table 5.**The results of Manova variance analysis for two groups

| variable | Sum of squares | Degree of freedom | Average of squares | F value | Level of significance |
|---|---|---|---|---|---|
| educational achievement | 113.28 | 1 | 113.28 | 71.53 | 0.000 |

Regarding table 5, the F value which is equal to 71.53 and regarding probability value which is smaller than ($\alpha$=0.05), then the above hypothesis is confirmed. It means "there is a significant difference between observed scores of educational achievement of experiment and control groups."

## IX.     CONCLUSION AND SUGGESTIONS

To use computer software and **course-ware** in math education is evitable because of the remarkable and fast development of science and technology, and also because of the power of this tool in creating powerful and deep math understanding.

The findings of this research is in line with [17] who knows the use of technology as a reason for deeper math learning and also in harmony with technology principles of national American council of of mathematics teachers (NCTM) . It [16] claims that technology promotes math learning, quicker and efficiently.
The least but not the last, technology should be inserted in teaching and learning in pedagogic settings as a cognitive tool in order to facilitate creativity, problem solving, analysis and evaluation. In other words, when

computer is recruited as a cognitive tool, it enables the students to utilize the course-wares to analyze issues and to organize unique knowledge representation and to share something they learn with others. [18]

But we should pay attention to this point that we should only use new technology (computer and the Internet) in teaching the learners to cope with the development and consequently achieve the goals. To adopt a sort technology that would be apt and concise in the process of learning pedagogy as a method is very important. It means method is prior to tool. In other words, to use a false tool in teaching and learning does not lead to learning nor does it also make some misunderstanding for students. "We should be aware of evolutions and facilities of technology, and how they interact with human's learning nature. We, as mathematics teachers, need to have realities and facilities in human learning information technology age". [12]

Two factors of educational technology application in schools are:

1. Quality and quantity of access to multimedia (to prepare required hardware equipment)

2. To prepare teachers to acquire skills in this field. [13]

There are three groups regarding teachers' attitudes towards educational technology application [13]. They are as follows:

1.**Those who do not know**:

This group of professors knows nothing about educational technology application, whether tool point of view or cognitive point of view.

2.**Those who don't want to know:**

These professors do not use educational technology intentionally because of hostility, their unanswered requests or unsecured social welfare and job security and they don't want to curtail and consume their energy.

3. **Thosethat cannot:**

These teachers mainly have rather proper knowledge of recognition and application of educational technology. Also there is no intentional hostility in their attitude but they cannot use their knowledge and skill efficiently, because of lack of facilities and life welfare, etc.

Shortly speaking, the extensive application of computer in universities and classrooms are required for several factors:

1. To change classroom structure and to represent new institutional learning patterns. (saadatmand).

2. Insufficient number of computer systems, at least one system for every two persons.

3. Improper physical environment for computer workshop.

4. Shortage of teachers' knowledge about computer application in educational settings.

5. And finally the most importantone is to attract teachers' consent and to give them more financial and socialsupport.

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