Effect of Instruction by the use of Multimedia Computer Software on Students’ Achievement

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Abstract

This survey was done to investigate the effect of teaching experimental science by computer to elementary students. Among elementary schools of Yazd 7 schools were randomly selected. One class of each school was selected as the control group and a second class as the experimental group. The students in the experimental group were taught by the use of multimedia software and computers for two weeks and the control group were taught traditionally by their own teacher for the same period of time. To assess the impact of these two methods of teaching, a teacher-made-test was developed and students’ performance on this test was compared on three levels of knowledge, performance and application. The results showed that students’ learning of the subject matter in the experimental group was significantly higher than students in the control group. The study revealed no significant difference between male and female students’ learning by multimedia computer software.

KEYWORDS: Educational software, Interactive software, Science teaching, Multimedia Training, Computer Assisted Instruction.

Introduction

The presence of computers and computer networks in modern societies has led to their reform and complexity. In fact, computer has imposed a meaningful change on their life style and manner of doing things, recreation and hobbies and nature of human relationships. The world education has not been an exception. Teachers’ and students’ activities, the place and time in which learning occurs, and the nature of learning experiences have significantly been reformed . A variety of learning tools has been created. Individuals participate continuously in formal or informal learning activities throughout their lives\textsuperscript{1}.

In recent decades, the penetration of computer and its software alongside its development in the field of education have guided teaching towards a specific path. Through these changes students are fostered to have a higher interaction with computers and pedagogical plans other than their teachers, peers and real world. The existence of a varied number of educational software has largely liberated training from the monopoly of classrooms and schools. It has fostered student's to pursue their learning through the use of computer software or educational networks\textsuperscript{2}.

Today, the advent of technologies that their power and ability are continuously increasing a variety of learning environments has also been created. In these open learning systems and environments, there exists electronic equipment and resources that through their utilization and by the effort made by students the learning situations can
be realized better. In such environments, students already know what is learned and what resources should be used or are used.

**Discussion**

Teaching and training at the present time are radically different from the past. Previously, training was conducted mostly in classrooms and at the presence of teachers. Nowadays, what has used to be generated in the form of several books and with spending a high amount of money can be produced much cheaper on a CD. Although, according to Edgard Dale’s Cone of Experience it is better that learning be practiced in a direct way and with first hand experiences; but discussion parts of most books, especially primary school’s books, are not project-oriented in which an issue can be put for wards in a certain period, and be looked upon from different angles. For example, in plants’ chapter of these books some issues about flowers and fruits or the overall phases of plants’ growth are discussed or in the chapter about animals issues about land, forest and aquatic animals are discussed that their first-hand experience or direct observation is visually impossible. As another example, in the Energy chapter, issues regarding dam, wind, nuclear and gas power stations are talked about that it is not possible to directly visit them or plan a scientific trip for students to direct experience them. One can bring a computer to the classroom and through designing appropriate educational programs; using simulation, visual and auditory tools involve students more seriously in the learning process.

Students are different in terms of their intelligence and personality traits; therefore, some of them learn the material faster and some later. In computer-assisted instructional programs individual differences will be noted. Strong students are not forced to wait for weak students and weak students can also have their own pace in learning the required contents, because they can repeat the materials as many times as they wish.

Today, traditional methods of teaching, especially teaching methods with a limited number of textbooks are considered as incomplete and passive. Because these methods do not foster learners to learn and important learning principles are not used in them. Teaching and training through the use of appropriate educational software is a method that does not have such limitations and utilizes important leaning principles. In the past two decades, using computers in educational environments and creating multimedia learning environments for enhancing the learning process has been largely increased. The rapid developments in the realm of science and communication have accelerated the use of computers and educational software in most of societies. Although in Iran, every day we observe a higher percentage of the use of these tools in the classrooms, but still they have not found their real position and the appropriate educational software for such a use have rarely been produced.

With the increasing presence of computers and the use of Information Communication Technology (ICT) in Iranian classrooms, the growing need for such a use in education, the special importance of primary school period and in particular the importance of science unit in that period, the researcher found itself in a position to carry out a computer-assisted teaching method in teaching Science unit in grade four of primary school and investigate its impact on his students’ achievements.

Computer-assisted instruction is a process by which written data and visual information is presented to the students in a logical order by computers. Computers provide services
to students as interactional tools and engage students in the learning process. Students learn through the provided material (images, graphics, animations, texts, sounds, and etc.) and get the necessary feedback.

The history of using computers in education goes back to four decades ago, and it is often referred to as computer-assisted instruction or computer-based training. In 1968, Bloom suggested several hypotheses regarding learning by computers. According to his view, computer can offer a series of tasks that must be learned one after another as a category or pack. The position of the Learner in each step is completely tied to the learning of the previous one. Since the acquirer performs the proposed steps one after the other, his learning will increase. Taylor also presented his theory about the use of computers. According to him, the computer applications provide the possibility of complete training and progression for all learners equally and each learner will have appropriate time to complete each stage of training. In 1967, for the first time, computer was used experimentally as an instructional tool in courses such as science, English and social sciences. At the same time, computers were also used in the implementation of classroom management task. In any channel of communication, media plays a major role in facilitating the transfer of messages between the sender and the receiver. In addition to facilitating communication and transmission, media has also other benefits in teaching and training such as:

- Providing first-hand learning experiences, or similar ones.
- Motivating students in the learning process and helping to perpetuate this motivation.
- Saving the training time.
- Providing faster, deeper, and more stable learning.
- Providing the learning of impossible experiences.

Educational materials and tools provide a tangible base for thinking and creating concepts. They create situations that cannot be obtained through other ways, such as:

- Visual spectrums that their details, due to their slow movements and emersion, cannot be studied. For example, through the use of quick video capturing techniques one can capture the processes that a flower goes through when it gets open.
- The events and processes that because of their high speed or fast emergence can hardly be investigated; such as, fluttering or winging of insects and birds that can be recorded by using quick video capturing techniques.
- Those things that cannot be brought into the classroom because of their large size, heavy weight, or lack of portability, such as refineries, factories' facilities, big machines, and etc.
- Those things that cannot be studied with naked eyes because of their small sizes, like microbes and other microscopic germs.
- Those things that generally it is difficult or impossible to access them under normal circumstances; for example, the investigation of body's internal organs and blood circulation in vessels.

Multimedia tools can be seen as interactive application of computer communication systems, in which the information is generated, stored, transported, and retrieved by text, graphics, visual and auditory networks. Interaction in computer is what the person does on the computer to use the program such as clicking on the various topics on the screen. Interaction allows one to access and observe what has gone before, move the objects on the monitor by clicking on the mouse (drag them), and answer the questions.
One of the most important parts of multimedia is the use of animation. Animation is made by putting together a series of fixed and related images and displaying them with a normal speed of fifteen frames per second. A great deal of multimedia productions utilizes animation that can be used for teaching. They can facilitate maintenance and retrieval of the content under certain circumstances. Multimedia increases students' motivation in learning. They are more flexible and effective than traditional learning methods. Students are surprised by the entertaining and powerful nature of multimedia tools, pictures, videos, texts, and sounds that are played when you click on the keys. If experts and specialist teachers produce good educational software, all students will benefit from the possibility of having a good teacher. There are some advantages of instruction with the help of interactional multimedia tools:

- In regular classes, if a student find herself in a position that cannot listen to the teacher even fora few seconds, she loses teacher’s speech; but in a learning situation that uses multimedia, if a student feels tried to listen to the lesson or something urgent came up to her, she is provided with the opportunity to pause at any moment and start again from the same part.

- Multimedia applications due to their simultaneous use of different senses in the learning process can create an appropriate learning environment for individuals who suffer any kind of disability in their visual, audial, or movement ability.

- Not only Multimedia is superior to written materials due to their multimedia nature, but also digital texts, because of their flexibility are far better than normal textbook. This superiority is due to the fact that students can change text’s color and size as they wish or use speaking software.

- By the use of IT and educational software, teachers are provided with opportunities to spend more time on motivating and encouraging students for learning.

- Multimedia creates student-centered classrooms by changing teacher's role from a lecturer to the facilitator of learning process.

- Access to information through multimedia makes students more interested in learning the materials and it generates a positive interaction between the learner and the curriculum.

- In computer-based educational programs, learners are not obliged to keep up with others. In fact, each person can progress with his own appropriate pace.

- Computers can relieve a lot of pressure from teacher’s shoulders; so they can work as expert programmers and consultants in the service of their students. Consequently, teachers have more time for designing powerful and effective instructional plans.

- Multimedia in the form of new educational frameworks helps teachers to consider their students’ needs and classrooms environment in a different way.

- Multimedia needs higher-level thinking and problem-solving skills. These projects develop non-linear thinking and give divergent students a chance to flourish.

- Multimedia creates student-centered classrooms by changing teacher's role from lecturer to facilitator of learning process.

- Due to the existence of pictures, videos, and animations on multimedia, these programs are very rich in terms of their content. Computer programs, particularly the multimedia, are very attractive. Multimedia applications have a set of written texts, music and designs, moving and fixed images, cheerful and attractive colors, and background sounds that can lead to the creation and maintenance of learners’ motivation toward learning process.
In a research conducted by Bialo and Sivin (1990)\textsuperscript{11}, (as cited in Cotten,1991)\textsuperscript{12} the participants stated the following reasons for their interests toward Computer-Assisted instruction (CAI):

- Computers are infinitely patient.
- They allow students to work privately.
- They never get bored.
- They are never disappointed or angry.
- They never forget to improve.
- They are funny and interesting.
- Learning is individualized. Everyone is responsible for his own learning.
- They do not embarrassed students who made mistakes.
- They make possible experiments with different options.
- They provide immediate feedback and also they are more objective than teachers.
- They are independent from teachers and have more meaningful contact with students.
- Learners with different races or ethnicity are equal to them.
- They foster students to have control on their own learning.
- They make use of visual, audial, and tactile senses.
- They raise the efficiency in the use of computers and this will be a positive background later in their life.
- They remove difficult tasks such as drawing diagrams by hand.

The main advantage of multimedia-based teaching and training to other educational programs is its flexibility in providing information and immediate feedback. The major goal of the multimedia is to help students to learn better and enhance their level of education.

Other benefits of using multimedia include:

- Stimulate learners to learn by inducing great enthusiasm in learners and making the learning and training process individualized.
- Giving practical experiences to students and providing them with opportunities to solve real problems.
- Helping teachers to handle the problems of the educational curriculum realm.
- Reducing instruction time.
- Repeating materials to achieve content mastery.
- Carrying out dangerous experiments in real situations.
- Providing opportunities to visit distant places.

Some restrictions on the use of computers and multimedia are as follows:

- The expensive price of computers.
- The need for maintenance and upgrade of computers.
- The lack of education and preparation of teachers to use computers.
- Teachers and administrators resistance against the computer.
- The lack of appropriate software.
- The need to have a certain location to maintain the computers.
- The unreflective and inappropriate reliance to the machine.
- The possibility of learners’ unsuccessfulness in acquiring the ability to express their thoughts completely.
- The possibility of developing personality disorders in learners through the use of computers.
And, finally, students’ expectations may rise to that level that they want all other types of teaching methods to be as effective as computer-based instructions.

Science is an important unit in the primary school period (ibid.). The present study is an attempt to compare the effects of teaching science through educational software with the traditional methods on student achievement in fourth grade, and whether the use of computers and educational software will lead to better learning and educational progress of the students or not. Thus the title of the study is: The effect of computer-based instruction on students’ achievement in grade four of state primary schools in Yazd.

**Research Objectives**

The overall objective of this study is to compare the effect of teaching methods that use interactive multimedia computer software with traditional teacher training method on student achievements in grade four of state primary schools in Yazd.

**The specific objectives**

1- Comparative assessment of students’ achievement in the traditional teacher training method and the computer-based instruction in grade four science class.
2- Evaluation of students’ achievement in the traditional teacher training method and the computer-based instruction, in grade four science class in terms of their comprehension.
3- Evaluation of students’ achievement in the traditional teacher training method and the computer-based instruction, in grade four science class in terms of its application.
4- Comparative assessment of male and female students’ achievement in the traditional teacher training method and the computer-based instruction, in grade four science class.

**Research Method and Population, Information Collecting Tools, Volume and Method of Sampling and Statistical Methods**

Regarding objectives of the study, the researcher used a posttest with control group and random-cluster sampling. In the study, 7 Classrooms were randomly selected from among 208 schools.

In fact at the beginning of each school year, students are ranked according to their previous year average score and teachers assign them to each class regarding these scores. Therefore, classes were approximately equal considering their students’ previous year average score and for the purpose of this study one class was randomly selected from the same schools.

The experimental group was trained by the educational software developed by the researcher. The control group was also trained by their own teachers.

The target population included 6,441 fourth-grade students in the city of Yazd. Samples of the study were 252 students from among 7 schools.

At the end of the training, Students were assessed by a teacher-developed test whose validity was confirmed by six teachers and considering the course objectives. For assuring the reliability of the test, the split-half reliability was used with a coefficient of 72.3%.
Results
The results of the analysis of the findings of the study are shown in the following diagrams:

**Figure 1:** Comparison of the mean score of control and experimental groups’ level of knowledge

As it is clear from the above figure, science knowledge level of the experimental group is higher than the control group and the difference between their mean scores is 1.974. Thus the level of educational achievement of the students in the experiment group is also higher than their counterparts in the control group.

To analyze the data obtained from the performance of students in two independent groups, a T-test was conducted. The results show that there is a significant difference between the mean score of the students trained by educational software and those who were taught through traditional teaching methods.

Therefore, Can say with 99% of confidence that instruction with the help of educational software had led to the progress of students in their science knowledge level.

The following diagram shows the mean score of the comprehension level of the experimental and control group:

**Figure 2:** Comparison of the mean score of the groups’ level of comprehension

As it can be seen in the above Figure, understanding level of the experimental group is higher than the control group and the difference between their mean score is 0.713. The use of the T-test to determine any significant difference between the mean score of comprehension level of students that were instructed with educational software and the students that were instructed through traditional teaching methods attested a significant
difference. Therefore, Can be 99% sure that instruction with the help of educational software had improved the comprehension level in the science course.

The following diagram shows the mean score of the application level of the experimental and control group:

![Figure 3: Comparison of the application means score of the experimental and control groups](image)

Application score of the experimental group was 1.954 and the control group 1.151, respectively. The difference between the mean scores of experimental and control group was 0.802. As it can be seen in the above diagram.

The use of the T-test to determine any significant difference between the performances of independent groups showed that there was a significant difference between the applications means score of students that were instructed with educational software and the students that were instructed through traditional teaching methods. Therefore, it can be said with 99% assurance that instruction with educational software helps students to make educational progress in their application in the science course.

The following chart compares the average scores of girls and boys in the experimental and control groups.

![Figure 4: Comparison of mean scores of girls and boys in the control and experimental group](image)

Scores of female students in the control group was 8.63 and in the experimental group were12.36. The mean difference between the groups was 3.73. The score of male
students in the control group was 7.21, and in the experimental group were 10.19. The mean difference between them is 2.98. In this study, the mean difference of female students of the experimental and control groups was more than male students in those groups.

The use of two-way ANOVA for determining any significant differences between the performances of independent groups about the effect of groups and the interaction effect of groups and gender showed that the scores of female students in both experimental and control groups are higher than male students. The score of students in experimental group, independent of their gender, is higher than the students in the control group. There was not also any significant difference between the educational improvement rate of male and female students in the use of educational software.

**Research Implications**

Recommendations based on the research findings will be presented in two parts as it follows.

I. Practical Implications:
- The need for holding Computer Training Courses for teachers and encouraging them to use new technologies in their teaching.
- Equipping schools with computer sites.
- Providing interactive multimedia curricula for different educational levels, especially elementary school students.
- Providing multimedia software with textbooks, instructional technology specialist, curriculum planning, and computer programming.

II. Pedagogical implications:
- The same research is done in other educational levels and over other courses.
- Investigating any possible effect of computer assisted instructions and computer use on the beliefs, traditions and religious tendencies of students.
- Investigating any possible effect of computer assisted instruction in the affective and psychomotor domains
- The effect of computer assisted instructions on students who learn late or those who are deaf, blind, or etc.

**Summary and Conclusion**

Today, computer-based learning environments, in its various dimensions ranging from educational CDs and games through education by internet networks, are rapidly expanding. Therefore the phenomenon of computer-based teaching, with its large and diverse dimensions, is an undeniable phenomenon in today's societies. An educational institution that's their most important role is in the progression and reform of civilization should welcome this modern phenomenon. So there is a need to implement research on its use in the educational realm. The present study was done on this issue to provide answers to the question of ‘Is computer-based instruction effective on the educational progress of students?’

**References**


