

Original Article



Investigating the Impact and Role of Technology in Teaching and Learning

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ABSTRACT

The present study examines the impact and role of technology in teaching and learning. Despite its short life, E-learning has entered well into all aspects of the educational system and has become widespread. Due to its special features, this system of education has found its place among educational experts and has been the focus of countless educational systems. Various reports published by organizations such as UNESCO indicate that information technology has caused fundamental changes in the learning process. Today, according to the diversity of societies, people, their creativity and interests, there is a need for diversity of learning methods and this requires a new form of education that has sufficient flexibility in this field. Recent developments in the computer industry and multimedia systems have provided ways to improve learning and better access to information. Computer-based instruction, which is often reciprocal or interactive, relies on the use of multimedia devices. Multimedia environments have created qualitative and fundamental changes in the learning process by increasing productivity. This evolution, which initially started with the employees training in institutions, has now reached the classrooms of advanced countries, and now in these countries, multimedia software packages for teaching high school and even elementary lessons are offered in various languages.

Introduction

Webster's dictionary defines technology as the way of doing things using technology. Paul Sattler considers educational technologies more of a process than a product [1]. The use of information and communication technology for learning goes back more than 5000 years. The invention of

writing with pointed instruments was the first information revolution that made it possible to create, store information, and communicate with subsequent generations. The second information revolution began after the invention of printing (1459) [2]. The third information revolution started only 50 to 60 years ago with the invention of the computer, which made it possible to transform raw data into organized information, transform

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information into knowledge, and transform knowledge into action using intelligent software and robots [3]. Bill Gates, the executive director of Microsoft, also points out that the computer is a powerful tool for education and for students to reach the new world of information, creating creativity and facilitating rich communication and extensive remote collaboration. Technology-based education is divided into online and offline communication. Online refers to the set of opportunities that learners interact with each other, with the teacher, and with the learning materials at the same time through the computer and the Internet, and in offline communication, this interaction takes place at different times. Technology-based classes enable the learner to choose and pursue the learning they need and instead of learning at a specific time and place, learning is provided at the right time [4].

In a meta-analysis of 219 studies conducted between 1990 and 1997, Sivini-Kachala (1998) evaluated the impact of computer technology on learning and achievement and reported that, first, regular and special needs students in a technology-rich environment made significant progress in pre-school age shows up to higher levels and secondly, students' attitude towards learning and self-esteem is positive. Psychological research shows that students receive only 15% of their information through listening, 25% through images, and 65% through hearing and seeing images at the same time and keep them in their memory. However, it is difficult for traditional educational methods to explain and show an educational material for one person at the same time. Therefore, this multimedia technology solves this problem and improves the educational quality by combining audio and video.

E-learning

Basically, E-learning is another way of teaching and learning. In its broadest definition, E-learning includes teaching and learning through all electronic media, including the Internet, intranets, extranet interactive learning processes, satellite program segments, audio-

visual tapes and television, and generally attempts to implement electronic education. Various words and terms such as; Computer-based education, CD-based education, online education, virtual education, web-based education, Internet education, and other terms to define the set of education provided to the learner through computer, multimedia, and Internet agents. They are considered as E-learning. Clark and Mayer consider E-learning as a type of learning that is done by computer through CD-ROM, Internet or intranet. This type of learning includes the following features:

1. Contains content appropriate to educational goals;
2. To facilitate learning, he uses different teaching methods such as examples and exercises;
3. It uses media elements such as images and words to convey content and methods;
4. It can be taught by an instructor (synchronous E-learning) or designed for individual self-study (asynchronous E-learning);
5. For the basis of new information and skills related to the individual learning goals, formed or improve organizational performance.

In E-learning, unlike the traditional method, i.e. transferring information on paper, the author or instructor does not limit himself to text, images and paper. In this method, animation, film, description (speech), music, visual effects, and exchange queries can be used and information can be presented in new styles in an attractive and exciting way [1].

Types of E-learning

In what environments and with what tools is electronic education provided? Electronic education has a wide scope and is divided into several categories depending on the type of use and facilities:

Computer-based training

In this method, training will be through the Internet. In most cases, tests and presentation of course content are also through electronics and computers. Classrooms, notes, pamphlets, discussion rooms, E-mail are part of the

features of this method and all are stored on the computer. Of course, due to the extraordinary flexibility of electronic education, you can design and implement the way you want, suitable for your activity, existing conditions and facilities. Therefore, some of the mentioned features may not exist in your system or may be replaced by other features.

Computer-based training

In this method, there is no need to connect to the Internet or even to a computer, except in special cases. In this method, information is stored on an electronic interface and the user uses it using a computer or electronic device. Using educational CDs that are very common in our country [2].

Education through mobile digital devices and tools

It is education provided through mobile digital tools such as PDAs and tablets.

Training through mobile phone

This training is completely new and can be roughly placed in the upper group. But due to the increase in mobile phone owners and the focus on this method, which has become known as "Learning through mobile phones". A separate category is considered for it. This method is easy to do. However, its requirement is the creation of telecommunications infrastructure. Many people, especially in urban communities, lose a lot of time waiting for vehicles, traffic. Until a few years ago, people carried books with them to make the most of this time, which had its own problems. For example, there was a lot of damage to the eyes on rough roads. With the advent of digital audio storage, learning has moved towards teaching through audio, but still teaching through eyes is the most effective.

Innovative educational experiences based on information technology

One of the comprehensive studies conducted in information technology applications in

schools was conducted by the "International Association for Academic Progress" between 1999 and 2002. This study, entitled "The Second Study of Information Technology in Education" has been carried out with the benefit of the results obtained from 174 case studies in the field of the use of information technology in the classroom. Based on the published reports of the findings of this study on the application of information technology in educational innovations in the classroom, considering 174 cases of educational innovations used in the countries under review, these approaches can be divided into eight groups or patterns as follows:

The first pattern: Innovations using information technology as a tool, which primarily differentiates them, the widespread use of productivity tools and electronic mail.

The second pattern: Innovations related to student collaborative research, which is a very complex model and its outstanding feature is the cooperation of students in the classroom.

The third pattern: Innovations based on information management, which is a complex model in which information technology is used to support information search activities, product production, student monitoring, and planning.

The fourth pattern: Innovation is the teacher's participation using information technology, the prominent feature of which is the cooperation of teachers with students, with fellow teachers in the school and with other people outside the school.

The fifth pattern: Innovation is using information technology to engage with those ones outside the school.

The sixth pattern: Innovation is using information technology to produce products.

Seventh pattern: Innovation is the use of information technology for training and practice, the outstanding feature of this model is the use of self-learning software for training, doing homework and practice.

The eighth pattern: Innovations based on information technology that do not fit in the above groups, their prominent feature is not having a special pattern.

Software and computers as teaching media

There are many opinions about the computer as a means of using multimedia software in teaching. Today, the wave of technology has covered the field of education like other fields of science, and many media can be used for the development of human horizons, provided that the decisions based on its use are measured. Therefore, many educational programs are implemented with the help of computers in the so-called multimedia format. Computer-aided education with multimedia capabilities can use different senses simultaneously in the process of multi-sensory experience and create a favorable learning environment for people with different characteristics. Computer-aided education includes three basic topics. The first discussion is entitled computer-aided education. In this view, the computer acts as a teacher and practices the new material with the learners, and the working method is based on exercises, questions, and answers. The second topic is computer-based learning and includes methods such as prototyping, educational games, problem solving, and information processing. The third topic is called the computer as a versatile tool and the implementation of the desired programs is the software responsibility [3].

Definition of multimedia

Mayer (2001) in his book entitled: "*Multimedia Learning*" first defines multimedia as follows: I define multimedia as the presentation of information using words and images. By words, I mean the presentation of material in a verbal form, such as printed texts and spoken texts (such as the speaker's voice in a multimedia educational program). By images, I mean presenting content in visual form such as statistical graphics including various shapes, charts, photos, and maps or using dynamic graphics including animation and video. The term multimedia refers to the collection of various types of visual and audio technologies with the purpose of communication, various types of multimedia include text, audio, graphics, and animation. Heinke and Molendavrasel: Multimedia is the combination

of several media including text, graphics, sound, still images, video, and animation that can be displayed with the help of a computer. It defines multimedia as the content presentation using words and images, which means graphic images, diagrams, photos, maps, animations and videos. By using the new phenomenon of multimedia, the computer is used as a teaching tool. In multimedia, lesson summary, graphic, and audio works are used in such a way that the teaching becomes conversational. Mr. Hoften (1994) defined the multimedia phenomenon as a set with the following components:

- A computer device;
- Program and relationships that relate information;
- Guidance tools that can be used to move between the aforementioned information;
- A method for summarizing, processing and communicating lesson materials with each other.

Why use multimedia in education

Educational multimedia provides rich resources that can be an opportunity for learners to grow, and that is to create a collaborative environment that allows learners and teachers to explore and explore a variety of issues. But educational software by itself has little effect on learning and teaching. Undoubtedly, this technology creates many opportunities for learning environments and causes significant educational interaction, but alone it cannot increase the quality of teaching and learning. This means that the learning and teaching environment, the supply of content, learner activities, how to implement learner activities, the process of measuring learners' performance and the feedback process should be formed appropriately, otherwise there is no guarantee of achieving educational goals [4].

"Cherry" says that there are twelve reasons for using multimedia projects in the classroom, which are as follow:

1. It increases students' motivation to participate in activities;

2. It combines all language skills such as reading, writing, listening, and speaking;
3. It creates cooperation skills among students;
4. It gives real reasons to read, write, and modify communication;
5. It provides more audiences for students compared to the teacher and the classroom;
6. It forces students to analyze sources and think in new ways;
7. It helps teachers to think in new ways for students and lessons;
8. These projects require higher level thinking and problem solving skills. They develop non-linear thinking and give divergent students a chance to shine in class;
9. It changes the role of teachers from the classroom speaker to the role of learning facilitator and creates student-centered classrooms;
10. Increases students' literacy and prepares them for the technology-driven communication skills needed in today's and tomorrow's workplace [5];
11. It allows teachers to recognize different styles of learning and thinking in the classroom;
12. It uses a set of resources and methods through which students learn best.

The difference between traditional education and computer-based education

The difference between traditional education and computer-based education can be examined in three major aspects.

The training process

Traditional approach: Method and content of education for all.

Computer-based education approach: Reciprocal and collaborative educational method and content for any type of education and for everyone.

Training time

Traditional approach: Time frame for all.

Computer-based training approach: The time period is determined by the training recipient.

Educational location

Traditional approach: Special place for everyone.

Computer-based training approach: Any place where the learner can access the training materials.

Classification of teaching patterns

There are different classifications of teaching models. The most famous and at the same time, the most comprehensive classification of teaching models, which covers other classifications, is the classification of Joyce *et al.* In this classification, teaching patterns are grouped in 5 families as follows:

The family of social patterns of learning: The patterns of this family consider learning to be the result of activity in learning groups and communities and generally through synergy. Social models of teaching emphasize the social nature of humans, how social learning occurs, and how social interaction enhances school learning. This family includes cooperation patterns, organized exploration, group exploration, role-playing, and judicial exploration [6].

The family of information processing models: This family emphasizes methods based on human inner curiosity to understand the world through gathering and organizing primary information, discovering problems, presenting their solutions, creating concepts, and transferring them. This family includes the model of inductive thinking, the model of understanding the concept, the model of scientific exploration, the learning model, the innovation model, the model of pre-organization and the model of exploratory skill learning.

The family of patterns of intellectual growth and adaptation: The patterns of this family, based on theories of growth, draw frameworks for thinking about students and educational adaptation with their individual differences, which includes the pattern of conceptual systems, cognitive development, and learning conditions [7].

The family of individual models: The family of individual models aims to shape education in

such a way that people can know themselves better, take responsibility for their education, and achieve a higher level of their growth to search for a higher level of life. In other words, the family of individual models, in addition to the belief that the development of the student as a person in terms of education is a valuable goal in turn, believes that more developed, positive and self-actualized learners are more capable of learning. This family includes the model of indirect teaching and the model of increasing self-esteem.

The family of behavioral systems: These patterns are based on the acceptance of humans as systems for dealing with their behavior, correcting and changing the behavior resulting from the information received from the way of functioning. This family includes mastery learning, direct learning, simulation, social learning, and reinforcement learning (conditioning) [8].

Teaching methods based on group participation

Cooperative learning is a method that emphasizes learning through working together. This approach emphasizes replacing what learners can do to create and manage learning through collaboration with others, rather than what the instructor or lecturer does. The term "Group-based learning" refers to an educational method in which learners at different performance levels work together in small groups towards a common goal. Learners are responsible for their own learning as they are for the learning of others. Therefore, the success of one learner helps other learners to succeed [9].

The concept of collaborative learning and the necessity of its application

Among the many different teaching models, cooperative learning can be mentioned. This model is structurally a subset of the family of social models and for teaching cooperation. The mechanism of this model, due to the presence of obvious and effective factors such as positive relations between members, cooperation in learning groups, individual responsibility, and satisfactory group outcomes, has led to positive

and significant achievements in the education of students. Collaborative learning helps to transfer learning through group to individual and interaction between learners with heterogeneous academic ability levels in the classroom by creating suitable conditions for learning strategies.

According to the authors of the book teaching patterns

"When we work together, we create collective energy, which is called summation. Social models of teaching have been created so that students can take advantage of this phenomenon by creating learning groups. Basically, "Classroom management" is about developing relationships based on cooperation in the classroom. Cooperative learning is an educational approach to teaching and learning that involves groups of learners working together to solve a problem, complete a task, or produce a product. Collaborative learning is based on the idea that learning is inherently a social act in which participants talk to each other and learning happens through talking. According to Srinivas, cooperative learning is an education that engages learners in working in groups to realize a common goal under conditions that include the following elements:

Positive dependence: Team members have to rely on each other to achieve the goal. If any team member fails to do his or her part, each member will suffer the consequences.

Individual responsibility: All learners in the group are responsible for doing their share of the work and mastering all the learning material to be learned [10].

Enhancing interaction: Although some work groups may be divided and everyone works individually, some should work interactively with group members giving each other feedback, with conclusions and reasons. They challenge each other, and perhaps most importantly, they teach each other and encourage each other to learn.

Appropriate use of collaborative skills: Learners are encouraged, and help develop and practice trust-building, leadership, decision-making, communication, and conflict management skills [11].

Group process: Team members determine group goals and alternately evaluate how well they have worked as a team and identify changes they need to make in their work to be more effective in the future [12].

Types of collaborative learning techniques

Slavin, in 1991, regarding cooperative learning techniques through learning together, states that in the summary of the research conducted in the field of cooperative learning, there are eight cooperative learning methods used in the latest researches and they have shown their effectiveness in achievements and have been approved:

Student team improvement groups in this way, students are divided into groups consisting of 4 to 5 people. In these groups, students are different in terms of gender, race, family, and cultural backgrounds, and previous experiences. The teacher first presents the lesson, and then the students in groups investigate and study the topic [13]. At the end, students participate in individual tests, and then the students' test scores are compared with their past average scores, and the final score is determined based on their progress compared to their past performances. Thereafter, the above grades are summed up and form the final grade of the group. Groups that improve to a certain level of the established progress criteria will receive a reward or certificate of achievement. All the above process, from the time the teacher presents the lesson to the group work and participation in the test, is usually done in three to five lesson sessions [14].

Team competition method or competition and team competition: In this method, the teaching method of the teacher and teamwork is completely similar to the previous method, but the difference is that instead of participating in the test, students participate in weekly competitions. In this competition, the students of each team compete in groups of three with students from other teams who have similar

educational backgrounds in order to earn points for their team. In order to make the competitions fair, the composition of the three-member groups that face each other is changed periodically. The points that each winner earns for his team are calculated regardless of the level at which he competed.

Individual learning or getting help from the team: In this method, four-member teams of students with different levels of efficiency are formed, and certificates are awarded to the teams that perform well. However, there are differences between this method and previous methods. For example, in the previous two methods, the education of students is provided collectively and uniformly, but in this method, collaborative learning is combined with individual education. In addition, the previous two methods are suitable for teaching many subjects and in most grades.

The pattern of receiving the concept: (Definition and implementation method) Getting the concept is "Searching and listing the representations that can be used to distinguish examples from non-examples of classes". Understanding the concept requires a student to compare and contrast examples (called examples) that include features (called instances) of that concept with other examples that do not include those instances, and thus the representations discover the category that currently exists in the other person's mind. Based on the studies done by Bruner, Gudna and Austin (1967) about thinking, the model of concept perception has been formed as a relative for the inductive model. This model, developed to teach concepts and help them learn more effectively, is an efficient way to provide students with organized information on a wide range of topics at every stage of the lesson. This pattern forces students to find out the concept that has already been formed in another person's mind by comparing and confronting examples (called examples) that have the characteristics of the concept with examples that do not have those characteristics.

Table 1. Teaching steps in the pattern of understanding the concept

The first level	The third level	The second level
Identify the concept	Analysis of thinking strategies	Concept acquisition test
<p>* The teacher provides examples for the new concept.</p> <p>*Students compare the characteristics and properties of positive and negative examples.</p> <p>*Students make hypotheses about the new concept.</p> <p>*Students express rules or definitions based on the characteristics and conjectural properties.</p>	<p>*Students explain their way of thinking.</p> <p>*Students discuss about how to discover a new concept.</p> <p>*Students discuss the characteristics of the concept.</p> <p>*Students discuss about the type and number of hypotheses.</p>	<p>*Students recognize and distinguish examples without naming and meaning with the title "Yes and no".</p> <p>Based on the characteristics of the new concept, the teacher confirms the hypotheses, names the concept, and expresses the necessary definitions.</p> <p>*Students give other examples.</p>

Conclusion

The pattern of understanding the concept has three basic stages, which will be introduced in the following.

First step: Identifying the concept

At this stage, the desired concept is presented in the form of positive or negative examples. Positive samples are shown below and negative samples are shown below. We tell the students that there are common properties and characteristics in the examples and positive examples that should be discovered and identified. Students compare and justify the characteristics of the samples and finally, name the received concepts and express their hypotheses. Confirmation or disconfirmation of these hypotheses is done in the second step.

The second stage: The test of understanding the concept

At this stage, students evaluate their understanding of the concept by identifying and distinguishing examples and unnamed examples of the new concept and presenting other examples of their own. At this stage, the teacher and students confirm or reject the hypotheses.

The third stage: Analysis of thinking strategies

At this stage, they analyze and check how the concept is received. Some students may start their hypotheses from general areas and

gradually move to components and discover and understand the concept (holistic individuals). Others start with limited and partial constructions and finally reach a general conclusion (persons who are partial or have inductive thinking). In both cases, they describe their way of thinking.

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