**Original Article**

# The Effect of Mobile Educational Factor in Multimedia on Students' Learning, Memory, and Learning Motivation

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## ABSTRACT

The characteristics of the current world are the rapid transformations that take place in various scientific and industrial fields. Education, which is one of the most important fields of human learning, is not exempted from these changes today with the arrival of new technologies, because education is one of the most basic needs in these changes. Education based on communication is possible. In fact, communication is the main and fundamental axis of all educational interactions, because the communication formation is not possible without the presence of the media. Therefore, media presence is essential for education. Education that uses text, image, sound, and animation in the direction of learning is placed in the field of multimedia. In fact, multimedia technologies are one of the new achievements that have greatly contributed to the knowledge expansion in information and in this field; they have been able to be effective in education and training in addition to the field of advertising and mass communication. In this regard, the standards and principles of multimedia design and production should be well respected so that the students can benefit from the advantages and merits of this achievement as much as possible so that the students are more motivated and interested in learning the subjects and principles of the course and thus meaningful learning can be achieved by following effective learning. Given that in today's countries, including Iran, the production of educational multimedia is growing and the use of multimedia in different educational levels is expanding. Their enrichment in the direction of learning is significant, and in this context, the mobile educational agent is a reality character designed to facilitate and increase learning and is used in educational software containing educational programs or educational skills. However, one of the new areas in the field of educational multimedia is the presence of personality and educational agent as a guide throughout the multimedia learning environment, which recently has increased the interest in using this educational agent.

## Introduction

Currently, the creation and creation of an electronic learning experience depends on the existence of a deep commitment towards knowing the different characteristics of this medium and the ways through which this medium can be used in the best way to transfer learning. In fact, this learning takes place in the network and Internet environment, and a set of multimedia technologies are used in its creation [1]. In computer-based learning, the user gains new experiences and higher levels of learning by having preliminary information or receiving it from the computer through trial and error, problem solving, insight, and creative activities. Educational software related to painting, animation, engineering and industrial design, educational games and conventional simulation programs are among these. Electronic learning has a great capacity to develop the educational horizon, and in this regard, it is necessary to enrich the field of multimedia. The mobile educational factor is considered as an emerging topic in this field [2]. Mobile educational agents have a huge potential to support learning because they have the ability to simulate a real classroom learning environment. Research findings show that because mobile educational agents are considered as social members similar to humans, they interact with learners in environments that require effective communication and interactions. Therefore, the mobile educational agent produces more definite results in increasing group learning. In fact, educational agents are real characters that appear as presenters on the screen and guide the user throughout the multimedia learning environment [3]. Using a mobile educational agent to provide education is similar to an educator teaching in a classroom, but a mobile educational agent is not the same as a real teacher and cannot exist alone. Therefore, it needs to be located in a learning system to provide support for educational setup [4].

### Now The Question Is Whether The Presence of Educational Factors In Multimedia Environments Is Useful?

"Research shows that teaching agents have the ability to play many roles in a multimedia learning environment, such as explaining, framing, coaching, modeling, and testing. However, teaching agents assume the role of a teacher or a coach [5]. On the other hand, Dunsworth and Atickson's research entitled: "*Learning Science through Multimedia*" indicates that students learn better in a computer-based learning environment when there are accompanying texts presented on the screen. In addition, the combination of narration with the visual presence of an animated learning agent may encourage students to process information more deeply than when the narrative or text alone appears on the screen [6].

The use of educational agents in a multimedia learning environment leads to greater acceptance of learners because it simulates face-to-face human interactions. Today, the mobile educational factor is considered to develop an intelligent education system. The findings indicate that the presence of emotions as a moving educational agent can be used to optimize students' motivation and learning. "Research on the use of multimedia learning tools has a history of more than twenty years, of which two tools are: Tutoring, intelligent systems, and educational agents" [7]. While a significant amount of time and resources are spent on designing and implementing learning agents within the learning environment, recent advances in computer-based systems technology have made the use of learning agents more accessible and affordable for educators. Computer is used in education in different ways. Computer-assisted education, computer-managed education, and computer-based education are examples of the use of computers in the teaching-learning process [8].

In the computer-based educational system, computers are used to provide education. The design of educational messages in the computer system is very diverse. The smart tutor is to

repeat and practice and simulate the examples that the computer-based system displays. Today, due to the rapid progress of new computer technology and the unique charms of computers [9], the design and production of multimedia learning environments has gained acceptance and acceptance for all people, especially teenagers [10]. In fact, the need to expand information and communication technology in education is the use of educational multimedia and multimedia systems, and of course, only access to computers and multimedia in schools is not enough for the effective learning of students [11].

The resources of students' learning activities are professionally designed and produced to create the necessary effect. If we consider education as one of the most important pillars of the country's development in all fields, we can realize the important role of multimedia in advancing development goals. It can be mentioned that the introduction of multimedia in education has created a revolution in teaching and academic performance of students. Studies indicate that if educational multimedia are designed and produced under a series of scientific principles and standards, they can meet students' learning needs as an effective educational material [12].

Multimedia can lead to more effective and deeper learning and problem solving by providing a rich environment full of diverse stimuli and establishing interaction and communication with the student. The reason why multimedia enhances learning is that people learn only 20% of what they see, 30% of what they hear, and 50% of what they see and hear [13]. If they see and hear at the same time, their learning will increase to 80%. By providing dynamic experiences, multimedia increases the speed of learning basic skills, and of course Wu also acknowledged this in the article Designing Multimedia Learning Environments Using Educational Factors: Factors and Issues in 2009. In fact, educational multimedia is one of the media systems that, due to their multi-sensory nature, can easily adapt to all kinds of learning styles and provide easy and stable learning interaction with various forms. "The most important advantage of multimedia compared to other forms of education is its flexibility in the field of information and its quick access in providing feedback, and the purpose of using multimedia is to help learners learn and increase their literacy. One of the areas of a new research in the field of educational multimedia is the research on the beneficial effects of the presence of a moving educational factor on the screen [15]. In this regard, it is possible to increase the interest and motivation of learning subjects for users through the mobile educational agent. In recent decades, the traditional ways of learning have undergone changes with the emergence of new technologies such as multimedia and telecommunications in such a way that these factors have constantly transformed and changed teaching and learning. The Internet has made teaching and learning exposed to a vast amount of information. E-learning is one of the phenomena of the modern world that has emerged in the information age and in the knowledge-based society, and in its short history, it has enjoyed a remarkable expansion speed. E-learning as an excellent opportunity to serve the educational system, especially higher education in our society (Iran), requires its deep and correct understanding as well as comprehensive planning with regard to the cultural, social, economic, political, and historical foundations and infrastructures to Implementation and localization. Developments in the field of technology have also affected the scope of education and caused many changes in that field. Although many of these changes are still going through their intellectual and philosophical aspects, some of these changes are coming with more force. These changes and trends can be divided into three parts:

(1) The initial part is related to infrastructure and basic activities; (2) The second part is related to the process that relies on these underlying technologies; and (3) The third section deals with trends based on these trends. Multimedia, Web, Internet, online information, and E-learning depend on computer and network technologies. Advances in these

infrastructure technologies make E-learning more powerful and reduce costs. On the other hand, the production of the underlying technology has led to the technological trends. A number of these trends are particularly important for the future development of E-learning [16].

### E-learning

E-learning provides the opportunity for learners to make decisions in matters such as participation in learning, the method of using tools, the time required for learning, the amount and level of learning, the place of learning, and the person teaching. Accordingly, they have a high motivation to learn. Researches have shown that the learning of these people is more stable and continuous, and the learning process is more responsible, because they monitor their learning speed, and most importantly, using technologies, they have the necessary skills to access, process the information needed for the purpose and they benefit from a special purpose. Clark and Mayer (2003) defined E-learning as education provided via optical disc, internet or intranet with the following characteristics:

(1) Inclusion of content relevant to the learning objective; (2) Use of interaction such as the use of examples and exercises to aid learning; and (3) Use of media elements such as words [17].

Creating new knowledge and related skills, in fact, E in E-learning refers to how learning is done (the way the content is stored). The word learning in the combination of E-learning refers to the nature (content and ways that help people in learning) and why learning refers to the cause of work (achieving individual and organizational goals). E-learning is the use of network technology to design, produce, select, manage and develop electronic technology [18]. E-learning does not create E-learning, but it is humans who create technology by exploring the assumptions of people's lives. In general, E-learning can be defined as follows: Any use of web and internet technologies to create educational experiences, of course, such a definition is quite wide and open and does not help much to choose the tools needed for a project [19].

The goal of learner-led is to deliver and distribute highly effective educational experiences to each learner, and this type of learning is also called standalone E-learning or self-directed E-learning. Its content can consist of web pages, multimedia displays and other interactive learning experiences that are located on a server and are maintained. E-learning is the result of the cycle of rapid developments and the expansion of new technologies in its true sense because technology has a software appearance before the hardware aspect [20]. From a philosophical viewpoint, electronic learning is based on a constructive and collaborative perspective, and according to experts, it is the most important technology that can support new approaches to education and teaching. Electronic learning has revolutionized the traditional teaching and learning methods and played a significant role in its completion and development. By accepting that "Interaction" has a fundamental and important role in the teaching and learning process, E-learning, using emerging technologies, provides extensive interactions to access vast and up-to-date information as well as various types of communication [21]. So far, various definitions of E-learning have been provided. Some of these definitions are as follow: According to Block, electronic learning refers to learning that takes place through the Internet. According to Mazi, electronic learning uses network technology to design, select, manage, and develop education. According to Nichols (2003) E-learning is the use of various technology tools that are based on the web or published by it and serve educational purposes. According to Keras who is considered by many as the inventor of the word E-learning, E-learning has six sign knows:

1. Electronic learning takes place through the Internet;
2. E-learning is accompanied by the latest information [22];
3. Electronic learning can include a set of educational methods;

4. E-learning is based on learning through effort and effort by the learner using new technologies;

5. E-learning provides the ability to perform administrative processes such as registrations, payment of tuition, monitoring the process of student activities, teaching and monitoring, and remote evaluation; and

6. Electronic learning is comprehensive and attention is paid to the individual characteristics of the learners.

According to Grayson and Anderson (2003), E-learning refers to that type of learning that takes place in the network and Internet environment and in a formal structure, where a set of multimedia, meta-media and telecommunication technologies are used. In any case, electronic learning refers to the type of learning that takes place in the network environment and in which a set of modern technologies such as multimedia, meta-media, and remote communication are used. In fact, the Internet is the main axis of the evolution that has created electronic learning. This type of learning takes place in the Internet environment and is facilitated through the use of network technologies, electronic tools, and network communications. The main and fundamental feature of E-learning, beyond easy access to information, is its communicative and interactive feature.

To achieve E-learning, the main problem is not access to information, because we are faced with more information than we imagine. What is needed now and what electronic learning offers us are better ways to process, give meaning to information and recreate them in such a way that this information can be transformed and entered into the field of human knowledge. This challenge is not only a problem in the field of technology, but it is a social problem and needs an educational solution. The US Department of Education defines E-learning with a broad scope, which was published in 2003: If a person uses information and communication technology in the course of learning, he is using E-learning [28].

The UK Ministry of Education states that E-learning has the ability to change the way we learn and provides quality and accessible learning for every person so that every learner can reach their full potential. In his E-learning article, Applemans (2002) classified the development of E-learning in four specific stages, including:

(1) Teacher-centered learning environment [29]; (2) Multimedia environment; (3) The first wave of E-learning; and (4) The second wave of electronic learning.

And these advances that have been made in E-learning are based on advances in technology, especially advances in the Internet. Electronic learning has a deep connection with the development of distance learning, and one of its main attractions is the possibility of access to learners at any time and place. E-learning is the use of the Internet for learning, which can be achieved from the Internet connection of the browser at any time and place. E-learning is a new type of education in which there is no need for the student to be present in the planned classroom. In fact, it is a virtual learning environment on the network.

### Educational Multimedia Definitions

Educational multimedia can provide organized programs of learning experiences for individuals or groups in which special emphasis is placed on learning through different senses. This is how Mayer defined educational multimedia. An educational multimedia message is: Communication using words and images that leads to the dissemination of learning [8-11].

### History of Educational Multimedia

The history of educational multimedia goes back 3000 years. When the Chinese used the light of the fire to cast shadows on the puppets in the curtain, and the sound produced was combined with the shadows. In fact, multimedia was generally formed in 1960 when moving tapes were used, and gradually with the development of technology, sound, music, text, and photos were added to it. The term

multimedia was coined in the 1950s when educationalists proposed multiple types of media to support increased learning effects. For more than 50 years, experts have been reminding that people learn better if they are involved in their learning. If multimedia technologies provide correct experiences and multi-sensory interaction to the learner, they can help teachers in improving the quality, retention, and attractiveness of education. Multimedia provides multi-sensory learning experiences to students [6]. Some researchers have already announced the presence of multimedia in teaching-learning. As Edward Thornduck envisioned interactive multimedia in 1912, Sidney Percy in 1994 designed a device to present test questions and provide instant feedback, and Skinner in 1968 stated that learning can be facilitated by continuous feedback and strengthen quickly.

## Elements of Multimedia Systems

The elements in the multimedia system are: 1. Text, 2. graphic images, 3. sound, 4. animation, and 5. video images.

## Text

It can be said that the text is the most important element in the multimedia program. Unlike other elements, the text element has the greatest impact on the quality of multimedia interaction. Generally, the text follows important information and the text acts as a link between other elements. In general, text is the simplest element of a multimedia product. Audio, visuals, animation, and video all require processing before they can be used in a multimedia product. However, the text can be simply typed and entered into the computer by the keyboard or digitized directly from the pages of the book. Text occupies less space than many media. In multimedia, text and writing can be combined with other media and create a powerful set to transmit information. In a multimedia project, text is used for headings, menus, navigation and expressing the contents of the project [12].

## Graphic Images

Graphic images provide the most creativity for learning. They can be photos, drawings, graphs from CD-ROM image spreadsheets, or sometimes taken from the Internet. If we have a scanner, it will include even extensive manual work. The graphic images in the lessons are only intended to present complex topics in a way that is easy to understand. Pictures can increase the motivation of learners to pay attention and understand better, help to remember and develop higher level thinking, and form concepts. Graphic images show and explain abstract and unfamiliar concepts. The most effective images emphasize important learning details. Additional images are distracting, especially for learners with limited attention spans and discrimination skills. Adding detail and realism to demonstrations does not enhance learning. Unnecessary details increase learning time without improving learning [13].

## Sound

Sound is a way of presentation. It is one of the tools of the multimedia environment that are used many times for the purposes of learning courses so that lectures, sound effects, and music add to the richness of the learning environment. Meanwhile, the voice of people is considered as a familiar and powerful tool for teaching so that one of the features of multimedia software is the ability to use sound, which distinguishes it from other printed media such as books. Many multimedia designers believe that the increase in motivation that occurs with the use of sound in multimedia facilitates learning through multimedia. Sound plays an important role in completing the effects of images, videos, and computer images on the viewer. The image conveys different messages to the audience, but in this transmission, the lack of sound element is quite clear. If you ignore the sound, what is presented will be like a silent movie. The right voice leads to stimulation of the imagination and the wrong voice leads to harassment [34].

## Animation

Animations are the idea of movement that emerges through successive displays of static images. Basically, animations are used to show an idea or explain a concept. Animations can be used to emphasize special details or aspects of complex phenomena. Transitions and animations are one of the easiest ways to add excitement to the teaching process. In expressing the difference between animation and video images, it can be mentioned that animations are designed while video images are usually taken from real life [35].

## Video Images

Since graphic images are not able to show complex movements, digital video films are used to show such movements. Video images such as animation are a key component in educational multimedia, and when they are included in an electronic course, they increase the interest and enjoyment of learners. The visual capacity of video is powerful, and when the concepts are very complex, video images can be used to make the concepts more attractive. Video should preferably be used as a supplement to textual information and can be good examples of textual topics and concepts. If the video image is related to the rest of the information on the screen and is not excessive, it can arouse interest. One of the reasons for using video images is the ability to call people's emotional reactions, such a reaction can be a strong motivational incentive [36]. Video, like other educational media, can have advantages and disadvantages, although it provides the possibility of qualitative learning, access to expertise and skills available at the world level for distance learners, teaching abstract concepts, unfamiliar and time-consuming, and things that are dangerous. However, problems such as the size of digital video files compared to audio and text files should be added to it. On the other hand, it is not easy to produce video images, and if video images are to be widely used and distributed, a lot of resources are needed. Video images that are produced for display on computers are somewhat different and have low resolution. One of the important

points in educational multimedia, in addition to interaction, is the synergistic feature of materials and media in multimedia. In other words, multimedia works far better than other separate tools and separate media [37].

## Characteristics of the Use of Animation in Education

(1) The flexibility of animation, different topics can be displayed in the form of animation; (2) Increasing motivation and reducing user fatigue; (3) Presenting topics with different movements and different attitudes; and (4) Being interactive and engaging the audience [38].

## Reasons for Using Multimedia In Education

Cheri considers the following good reasons for using multimedia: (1) It leads to the participation of learners in activities; (2) It includes all language skills, including reading, writing, listening, and speaking in the fields related to the academic program. It creates cooperation skills in learners; (3) It provides real reasons for reading, writing, and improving communication. It assigns audiences to learners beyond the teacher and the classroom; (4) It forces learners to analyze sources and think in new ways; (5) It helps the teacher to look at learners, classes and lessons in a new way, which will lead to feedback and revision of teaching strategies [38]; (6) Multimedia projects require high-level thinking and problem-solving skills. These projects promote non-linear thinking and equip different learners to shine in the classroom; (7) Multimedia projects change the role of the teacher from a speaker and authority figure in the classroom to a coach and facilitator. They create a learner-centered classroom; and (8) It increases students' literacy and creates technology-oriented communication skills that will be necessary for work in the current and future fields. Multimedia allows the teacher to identify multiple intelligences and learning styles in the classroom. Multimedia uses a range of resources and methods to help learners learn better.

*General Design in educational multimedia*

*Lexel Believes that the Following Should be Used in the Multimedia Design Process*

*Simplicity:* The multimedia screen should be readable and accessible;

*Balance:* Do not use too many different media elements, sound, text, and image;

*Coordination:* The color and structure of the shape on the page should be appropriate;

*Correct routing:* To use the keys correctly, the necessary information about them should be applied.

*Cognitive Processes in Multimedia Learning*

*Choosing words and images:* The initial step is to pay attention to related words and images that are presented in the educational materials.

*Organizing words and images:* The second step is the mental organization of selected images and words in coherent verbal and visual representations.

*Integration:* The third and final step is the integration of verbal and visual representations with each other and with Clark's previous knowledge.

When educational multimedia programs are designed in such a way that they are in accordance with the functions of the human mind and research-based principles, it will lead to meaningful learning that depends on the active cognitive processes of the student. Learners may encounter three types of cognitive processing to process the educational content presented to them. Given that the active memory capacity is limited, educational designers pay attention to these three types of cognitive processing and deal with it according to each one:

*External processing:* It is cognitive processing that does not support the learning of educational content and is caused by poor educational design.

*Basic processing:* It is cognitive processing that considers the mental representation of educational content (mainly including the selection and elements of educational materials and connecting them with each other) and

originates from the inherent complexities of educational content [29].

*Generative processing:* It is a cognitive processing that considers a deeper understanding of educational materials (mainly including organization and integration) and originates from the learner's motivation for better learning. Instructional designers should create instructional content and materials that minimize extrinsic cognitive processing, manage core cognitive processing, and maximize generative cognitive processing [30].

## Conclusion

The interesting point in multimedia education is that the understanding of the content is finally achieved when the learners can create a meaningful connection between the multi-sensory data and in this way connect the multi-faceted symbols. One of the limitations of using multimedia in educational programs is the need for advanced computers, and computers with low speed cannot support multimedia packages with a large volume (due to sound, image, and animation). On the other hand, for multimedia production and its creation by teachers and trainers, they should be trained, and also the fear of users due to the need for technical knowledge to use educational content, the occurrence of negative results due to spending too much time and carelessness in the field of education.

Among the obstacles of using educational multimedia. According to the inclusive approach of multimedia, those multimedia designs that are compatible with the way the human mind works work more effectively than those designs that are not compatible with the way the human mind works. Accordingly, research on the effect of multimedia on various curricular concepts and educational field can lead to the production of more effective multimedia and improvement of educational methods. One of the variables that can be examined in this research is motivation for progress, which is one of the most important factors within an individual and has been the subject of numerous researches. Motivation is a cognitive factor that affects individual

performance and behavior, which privately affects the type of activities that people choose and the level of their involvement in the activity, the level of persistence in doing them, and the result of the actions. Ryan and Desi (2008) investigated the nature and effectiveness of academic motivation from contextual factors in the theory of self-determination. According to this theory, being motivated refers to having the motivation to do things, and when a person does not have the power or source of motivation to act, he is not motivated and is not motivated, in contrast to a person who is pushed forward or works to achieve a goal, he is motivated. This theory makes a distinction between two internal motivations for performing behavioral and psychological activities without the need for external stimulation or a reinforcing relationship and external motivation, engaging in tasks that are a means to achieve other goals. In other words, it can be said that motivation is a force that gives strength to behavior and directs it and makes the student inclined to consider learning activities with meaning and value and try to obtain scientific benefits from them. The research on the topic of multimedia has been started for many years in developed countries. For example, we can refer to this research: Raukavita *et al.* (2009), in an extensive review, have evaluated the use of multimedia not only in regular teaching, but also acknowledged that the use of technology is effective on the future outcomes of education and the involvement of students in learning activities. It will lead to an increase in their motivation and ultimately positive consequences.

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