Augmented Reality-Based 3D Instructional Environment to Improve the Technical Skills and Academic Achievements of the Students

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Abstract:

The current research aims to identify the effect of different styles of augmented reality communication in three-dimensional e-learning environments to improve the technical skills and academic achievement of the students at the College of Computer Science, Jazan University, and the research sample consisted of 39 students in the Department of Information Technology and Security at Jazan University on three groups. Each group consists of 13 students, and the two researchers divided them into three experimental groups with a different pattern of communication in each group.

The research came out with a set of results, the most important of which was - there is a statistically significant difference at the level of (0.05) between the main achievement of the experimental groups for the research. Due to the basic effect of the communication pattern with augmented reality technology for the benefit of the group that combines the two types; synchronous and asynchronous communication, and there is a statistically significant difference at the level of (0.05) among the average skill performance of the experimental groups for the research is due to the basic effect of the communication pattern with augmented reality technology in favor of the group that combines the two types of synchronous and asynchronous communication.

Key Words: Augmented Reality, Synchronous, Asynchronous, Technical Skills, Academic Achievement

1. INTRODUCTION

The world is now witnessing a great and rapid civilization leap in light of the information technology revolution. A great development has been achieved in scientific and technological progress, and the power of nations is no longer measured by the number of their members or their natural wealth only. Rather, it is measured by what is available to it of knowledge based on science, culture, and education which is one of the pillars of national security in developed countries and determines the state’s level and its position among the countries of the world. The development of information technology, network, and communication systems has led to a clear change in all fields, especially in the field of education. Educational institutions are no longer the only educational environment for providing education and learning services, with the emergence of the term E-Learning to a large extent in education services. The most important applications of communication technology in the field of education. At present, there are many challenges to face the transformations of traditional education to e-learning or virtual education based on digital and visual technology associated with advanced information and communication technology cohesion, and among these challenges are:

1.1. Using modern technologies in appropriate proportions and applications in the teaching and learning process.
1.2. The increasing diversity in the educational process and its relationship with students or learners prepared marginally. Secondly, they are enrolled in official educational institutes and schools, and they need new ways to learn them throughout their career and community life.

1.3. Demand within the changing life community increasingly emphasizes the importance of acquiring flexible competencies in light of teamwork-based work structures (Muhammad Al-Hadi, 2005, 94).

Expectations indicate the spread of the e-learning system over internet in many countries of the world. Due to its importance, which has been emphasized by many foreign and Arab studies, e-learning is considered essential in many countries and universities that currently work with e-learning in addition to many universities in the United States of America and Japan. Arab countries, taking the names of the virtual university, the virtual university, and the interest in the spread of these universities has increased to the adoption of many international bodies and organizations to support the establishment of this system in university education, such as the World Bank financing the African Virtual University AVU, and the support of the Hanoi summit in the establishment of a virtual university of francophone agency affiliated La Francophonie. (Mohamed Abdel-Hamid, 2005,10). The idea of virtual reality comes from the extent to which the learner can enter a virtual world created by default and wander within it. A person can see himself inside the crater of an explosive volcano and around it flying lava, or for a person to find himself wandering inside the respiratory system and moving between the vocal cords. All this happens while the person is sitting in front of the computer, and this is what we call virtual reality, which is what happens when the simulation exceeds its limits and enters the imagination and becomes complete realism in which the user interacts fully (Sermsak Buntha, 2009,7). Augmented reality is simply a three-dimensional technology that merges between real and virtual reality, that is, between the real object and the virtual object and interacts with it in real-time while the individual performs the real task, and then it is a composite display that combines the real scene that the user sees with the computer-generated virtual scene, which doubles scene with additional information. So the user feels that he is interacting with the real world, not the virtual with a goal improving user perception. Tom Caudell, researcher at Boeing Company, were the first to introduce this term in 1990, in conjunction with his colleague David Melleil, when he asked them to find an appropriate alternative to electrical wiring drawings and expensive devices used to direct electricians on the factory floor as an alternative to plywood panels that are designed individual wiring instructions for each aircraft (Muhammad Atiya Khamis, 2015,2).

Figure (1) A student while using Augmented Reality environment

Among the previous studies that were based on augmented reality technology is the study (Al-Jawhara Ali Al-Dahasi, 2017) using augmented reality technology in developing mathematical thinking skills. The study aimed to identify the role of augmented reality technology in teaching
As the study sample consisted of (120) teachers Mathematics in the elementary stage in the city of Dammam, and the results of the study were positive for the use of augmented reality technology in teaching mathematics as it helps to become familiar with the subject matter and helps to increase the students' cognitive abilities and helps to take into account the individual differences between students. Among the previous studies that have been based on augmented reality technology is the study (Amal Ibrahim Hamadeh, 2017) “The effect of using augmented reality applications on mobile devices on developing the achievement and creative thinking skills of fourth-grade students,” where the research aimed to know the effect of augmented reality on associated achievement in science and creative thinking among fourth-grade primary students and what is the effect of using augmented reality applications on mobile devices outside the classroom (home on their own devices) on the development of achievement related to the science course and creative thinking among fourth-grade primary students, and what is the effect of the difference between the use of augmented reality applications on mobile devices inside and outside the classroom on the development of achievement in the science course and creative thinking among fourth-grade students. The results in this study concluded that there is a statistically significant difference at the level of significance (05.0) between the scores of the students of the first experimental group in the pre and post applications of the cognitive achievement test related to the science decision and the creative thinking scale in favor of the post application, and the results in this study reached. There is a statistically significant difference at the level of significance (05.0) between the scores of the second experimental group students in the pre and post applications of the cognitive achievement test related to the science decision and the creative thinking scale in favor of the post application. There is also a statistically significant difference at the level of significance (05.0) between the scores of the students of the second experimental group in the post application of the cognitive achievement test related to the science course and the scale of creative thinking in favor of the post-performance of the second experimental group. There is a positive correlation relationship between the grades of the experimental group students. The second in the cognitive achievement test and the measure of creative thinking skills in the post application.

Among the previous studies based on augmented reality technology is the study (Abdul Raouf Muhammad Ismail, 2016) “The effectiveness of using projective and planned augmented reality in developing the academic achievement of the computer network course among educational technology students and their motivation in the investigation activities and their attitudes towards this technology.” This study aimed to identify the effectiveness of using projective and planned augmented reality technology in developing the academic achievement of the computer network course among educational technology students and their motivation in investigation activities and their attitudes towards this technology. The study sample consisted of students of the fourth year in the Department of Educational Technology, where it included (30) male and female students as a control group that studied in the usual way, (30) male and female students as an experimental group that studied using augmented reality, and that study found statistically significant differences in the degrees of student achievement. Augmented reality technology, with its two types, projective and planned, in levels of achievement (understanding, application, analysis) and the presence of statistically significant differences in the development of trends attributable to the method of teaching and in favor of AR technology in developing motivation in the investigation activities towards learning.

An effective utilization of the augment reality environment needs to deal with both synchronous and asynchronous communication. Therefore, the aim of this research is to develop an Augment reality based 3D Instructional environment using Synchronous and Asynchronous communication to improve the technical skills and academic achievements of the students.

2. RESEARCH PROBLEMS

From the previous introduction, it can be seen that there is a new perception of increasing the degree of interaction between the learner and the electronic content, as it keeps the electronic content from tampering with its content, and leads to the separation of the digital content from the program design and the user interface (User Interface). This perception has been reached based on the perception of informatics workers that the method of designing visual output affects the users' understanding of the information provided to them as well as their perception because the good
design of screens affects the accuracy and validity of the data and the modern model and here is the three-dimensional model that represents Augmented reality technology, reality and fields of application. Through the work of the two researchers at the Deanship of E-Learning and Information Technology and the College of Computer Science and Information Technology at Jazan University, and their teaching of computers, the researchers encountered many obstacles that can be summarized as follows:

- Every student himself can't participate in the practical side of time constraints, which leads to failure to achieve the desired level of skill for each student.
- The danger of performing some practical applications, such as disassembling internal computer parts, as they are stored with electricity.

**The main reasons that called for the current study can be mentioned as:**

- Impaired skill practices.
- The lack of time to provide for learning and meeting individual differences.
- The absence of opportunities to deal directly with all the elements of learning.
- The seriousness of some experiments.
- The difficulty of relying on education systems and the presentation of some educational situations, especially those related to skills such as equipment maintenance.

From the above, many of the obstacles in the real system are evident, the importance and benefit of augmented reality are evident, which the researchers have previously identified and which are emphasized by previous studies, namely: Augmented reality saves significant expenses spent on training through real systems. Also, augmented reality is used to reduce the danger of the real system, like atomic reactions, nuclear reactors, and piloting of aircraft. As well as destroying computers, the whiteboard device, data show, and other educational equipment for educational technology laboratories, which in some institutions may cost several thousand to set up and the number may reach one million. Augmented reality programs are not just traditional educational programs that the learner interacts with by controlling the presentation only, but programs similar to the situation that the learner will practice later.

Through this data, which the researcher has collected, there must be another method that helps in providing educational services to ensure the provision of an appropriate, and effective educational service for students of educational technology, and how effective is this proposed method to improve the technical skills and academic achievement of educational technology students.

**The research problem can be dealt with according to the following question:**

What is the effect of different patterns of augmented reality communication in 3D e-learning environments improve the technical skills and academic achievement of the Faculty of Computer Science at Jazan University?

**Through this question, several sub-questions branch out?**

- What is the augmented reality technology in the current study?
- What are the augmented reality programs and tools?
- What are the computer skills and maintenance?
- What is the effectiveness of using augmented reality to improve the basic technical skills for computer use and maintenance?

3. **RESEARCH AIMS**

The current research aims to identify:

3.1. The effect of communication patterns (synchronous - asynchronous - both types) with augmented reality technology, to improve the technical skills and academic achievement of computer science students.
3.2. A comparison of the effect of different communication styles (synchronous - asynchronous - both types) on each of the technical skill and academic achievement on computer science students.

4. RESEARCH IMPORTANCE

The results of this research can contribute to:

4.1. Providing advanced scientific solutions to the university education problems that keep pace with modern technological developments in the field of education.
4.2. Developing the educational process by providing educational courses with modern technological methods that attract learners and increase the effectiveness of education.
4.3. To benefit in developing e-learning in the field of educational technology by employing augmented reality technology.
4.4. It helps to take advantage of the capabilities available to the colleges effectively and effectively through computer labs and virtual reality laboratories through augmented reality programs.
4.5. Reducing the cost of learning while increasing effectiveness and educating the largest possible number of students with equal educational opportunities.
4.6. Contributing to improving students 'education in computer and information technology departments in colleges of education and other colleges interested in teaching computer courses and overcoming the difficulties of the practical side in the use and maintenance of educational devices.

5. RESEARCH HYPOTHESES

5.1. There is a statistically significant difference at the level of (0.05) between the achievement of the experimental groups for the research due to the basic effect of the communication pattern with augmented reality technology in favor of the group that combines the two types of synchronous and asynchronous communication.
5.2. There is a statistically significant difference at the level of (0.05) between the average technical skills of the experimental groups for the research due to the basic effect of the communication pattern with augmented reality technology in favor of the group that combines the two types of synchronous and asynchronous communication.

6. RESEARCH LIMITATIONS

The study adheres to the following limits:

6.1. Objectivity: The research is limited to the course on human interaction with the computer.
6.2. Humanity: The application of this research is limited to a sample of students of the Department of Technology and Information Security of the Faculty of Computer Science and Information Technology.
6.3. Timing: implementing the proposed program in the 2019/2020 academic year
6.4. Resources: www.secondlife.com

7. RESEARCH METHODOLOGY

The two researchers used the semi-experimental approach in identifying the success of using communication patterns with augmented reality technology by verifying the study hypotheses and measuring the effect of using that technology in presenting the computer course at the College of Education in the New Valley by examining the relationship between the independent variable and the dependent variable.

7.1. Research variables:

7.1.1. Independent variable: the patterns of communication with augmented reality technology.
7.1.2. Dependent variable: the students’ technical skills and academic achievement.
7.2. Research Sample:

The two researchers selected a random sample of 39 students in the Department of Technology and Information Security, and they were divided into three groups randomly. The two researchers will divide them into three experimental groups to be taught using augmented reality with different communication styles for each group.

7.3. Experimental Design:

<table>
<thead>
<tr>
<th>Experimental Groups</th>
<th>Pre-achievement measurement and observation of skill performance</th>
<th>Experimental Treatment</th>
<th>Post-measurement achievement and observation of skill performance</th>
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<tbody>
<tr>
<td>The experimental group (1)</td>
<td>(1) BC</td>
<td>M 1</td>
<td>C (1) b</td>
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<td>Using augmented reality through a simultaneous communication pattern</td>
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<td>Experimental Group (2)</td>
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<td>Using augmented reality through an asynchronous communication pattern</td>
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<td>The experimental group (3)</td>
<td>(3) BC</td>
<td>M 3</td>
<td>C (3) b</td>
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<td>using augmented reality through the two modes of synchronous and asynchronous communication</td>
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7.4. Statistical Methods:

The current research used the One-Way Analysis of Variance (ANOVA), and statistical analyzes were made on the degree of gain, which represents the difference between the post-measurement score and the pre-measurement score on the skill-based scorecard, and the academic achievement test.

8. RESEARCH TOOLS

The research required the following tools to be performed.

8.1. A list of educational objectives for the content and maintenance of the educational devices unit.

8.2. An achievement test to measure the cognitive and skill dimension - prepared by the two researchers.

8.3. Note card for students’ skill performance - prepared by the researchers.

8.4. Some of the devices for the augmented reality environment (helmet, electronic gloves, electronic glasses).

9. RESEARCH TERMS

9.1. Augmented Reality:

Augmented reality is known as a type of virtual reality that aims to replicate the real environment in the computer and enhance it with virtual data that were not part of it (Al-Naji, 2013, 7). The researchers identify it procedurally as a technological system that allows the introduction of virtual components and elements in real worlds environments in conjunction with their occurrence in real-world environments, through which it is hoped that the perceptual and sensory side of the learner is enhanced from the side of the reality that lives and uses high-design tools and components of images, videos and 3D objects and provides information in it interactively at the same time to achieve specific educational goals.

9.2. Synchronous:

It is the mode of communication through which information is transmitted at the same time without delay, whereby data is exchanged between users at the same time directly. Examples of
this pattern are virtual reality programs, 3D chatting (Heike Hufnagel & Mareike Geisen, 2007).
The researchers define it procedurally as the pattern in which learners interact in a computer
subject simultaneously through their communication at the same time on the Internet through 3D
chat programs.

9.3. Asynchronous:
It is the mode of communication through which the transfer of information is stored or
archived, and then the learner enters and receives the information (Bob Hoffman, 2007). The
researchers define it procedurally as the pattern in which learners interact in a computer subject
asynchronously through their communication on the Internet through the Second Life program,
which the researchers used and support AR technology.

9.4. Technical Skills:
It is defined as the easy and accurate performance of a particular activity while saving them
time and effort expended. It is defined procedurally in the research as the possibility of easy and
accurate implementation of the correct performances related to the Internet in the least possible
The two researchers identify the skill as a procedure: "The ability to perform a set of steps
related to a specific work in succession and coordination with minimal effort, accuracy, and high
efficiency."

9.5. Academic Achievement:
Academic achievement is defined as the outcome of what the student or student has
reached in their education of information and experiences in academic subjects during a limited
period or the end of the school year that reflects several grades, and it is a set of degrees obtained
by the student (Abd al-Rahman Muhammad Muhammad al-Isawi, 2000, 166).
The two researchers define academic achievement procedurally as the amount of scientific
knowledge that the student has acquired related to computer topics and its maintenance in the
professional diploma specializing in educational technology.

Second: The general framework for research
Augmented Reality or what is called Augmented Reality from the new terms that have
appeared recently, and by the openness of education to technology and the pursuit of its pioneers
and theorists to take advantage of the latest technology in motivating learners and making the
learning process more fun, interesting and exciting. It has found Augmented reality technology
makes it's way easily into the field of education, to contribute in turn to redefining learning, making
it meaningful (Al-Hussein Obari, 2015, 2).

9.7. The Concept of Augmented Reality:
Augmented reality is a type of virtual reality that aims to replicate the real environment in a
computer and enhance it with virtual data that it was not part of. In other words, the AR system
generates a composite view for the user that mixes the real scene that the user is looking at and the
virtual scene created by the computer that enhances the real scene with additional information. A
computer-generated virtual scene aims to improve the perception of the real world that the user is
seeing or interacting with. Augmented Reality aims to create a system in which it is not possible to
perceive the difference between the real world and what has been added to it using augmented
reality technology (Abdul Raouf Muhammad Ismail, 2016, 162: 161).

9.8. History of Augmented Reality:
It is believed that the term augmented reality was first devised by former Boeing
researchers (Thomas Caudell in 1990), but this term was used decades before Thomas, as the first
applications of augmented reality date back to the late 1960s and 1970s. In 1962, (Morton Heilig)
cinematographer designed a motorcycle simulator with sound, image, and even smell, called it
Sensorama. In 1966 (Ivan Sutherland) developed the first 3D projector in the form of a helmet.
1975 also saw the creation of Myron Krueger, the video place device, which enables users to
interact with virtual objects (Bacca et al, 2014). Before 1990, augmented reality technology was used exclusively by several major companies for simulation, training, and other purposes. However, this situation will gradually change thanks to the development of wireless technology, the shrinking of technical devices, and the adaptation of the informational programs that augmented reality needs to test this technology in personal computers and mobile devices. Mobile applications for augmented reality began to appear in 2008, and the field of maps and social media was the first to benefit from this technology, and its use for training in the field of medicine and the military field is the most advanced, while the application of augmented reality technology in education is still in its infancy (Maha Al-Husseini, 2014, 29).

9.9. Augmented Reality applications in education and its uses

Augmented reality is used in many educational fields, such as tourism guidance, medicine, and construction, and it is also used in virtual environments where the user interacts with the exhibits as if they are real in sound and image and thus can see and hear things and information as they occur in nature using rich media while watching the real reality, and becomes part of it and interacts with it as if it is interacting with the real, and is more clear than the real, as augmented reality adds information to the scene (Muhammad Atiyah Khamis, 2015, 2).

The uses of augmented reality in education can be divided into:

9.9.1. Prospects for Augmented Reality

This technology allows you to do just that by projecting virtual layers of digital information onto the physical world, which can be viewed through smart devices that have become accessible to students and teachers. With augmented reality products like Elements 4D, students can virtually manipulate chemical elements and create interactions between them through their smart devices, instead of just reading about them in a textbook. They can also, through the same technology, perform an anatomy of the human body through the Anatomy 4D application, which allows users to explore the human body and isolate different body systems.

9.9.2. Classroom Applications

Several applications can be employed to bring AR technology to your classroom, as these applications allow users to create and integrate into their own augmented reality experiences, with ease and convenience, and by employing their personal or school devices.

9.9.3. Homework Supported by Explanation

Augmented reality technology can be used to support learners and accompany them when they complete homework. When a student stumbles in accomplishing his homework, he can use his mobile phone camera to aim at the point that is difficult for him to show him a video prepared in advance by his teacher, explain that point, and provide him with elements that help him solve the problem.

9.9.4. Live Photo Gallery

Augmented reality technology can be used to prepare a photo gallery of the faculty near the entrance to the college, where visitors can check a picture of any teacher with their mobile phones.

9.9.5. A Presentation about a Book

Students record a brief presentation of the book; they just finished reading. The presentation is converted into an attached digital information card utilizing an information program prepared for this purpose. Affixed to the book cover, and it enables anyone to immediately access the recorded presentation and learn about the topic Book by scanning the information card by the mobile phone.

9.9.6. Live Photo Album

A photo album can be prepared for the activities of the school year, such as parties, outputs, seminars, and the like, and every person who wants to know additional information on a specific activity can pass his mobile phone over the picture to show him the activity video and all the information, statistics and reports related to it.
9.9.7. Safety Lab
Pictures or cards bearing the safety symbol are prepared and attached throughout the science lab so that they occupy multiple media when students examine it with the cameras of their smart devices, to inform them of the various safety procedures and protocols for the laboratory equipment. It is also possible to design interactive programs for students in the science lab that display detailed simulations of the performance of experiments or follow chemical reactions of high risk and cost. Also, medical students can practice surgeries or diagnose the disease through patient simulation programs, and students in colleges of commerce can practice marketing and financial skills through simulating companies and factories (Anderson, E., Liarokapis, F, 2014,40).

9.9.8. Flashcards for the Deaf and Hard of Hearing
Using augmented reality technology, flashcards can be prepared to contain vocabulary that will be linked with videos showing how to express these vocabularies in sign language.

9.10. Advantages of using augmented reality in education, including:
9.10.1. Augmented reality environments help learners think through learning processes.
9.10.2. Displays volumes in real scale and natural shape that matches the human vision.
9.10.3. The augmented reality environment achieves safety for its user when studying information that is dangerous or difficult to obtain at a time and place.
9.10.4. Enables the learner to move within time, and present situations from the past time or accelerate the presentation of the future.
9.10.5. Help the user achieve his desired level of skill with high accuracy.
9.10.6. The learner's interaction with augmented reality is equal to what can be achieved with real reality (Patricia H. Werhane, 2012,169).

9.11. Types of Augmented Reality
Dunleavy, Dede (2014,65) divided the augmented reality into the following two types:
9.11.1. Outline: is a method of combining augmented reality with virtual reality, and it is one of the types of augmented reality based on the principle of giving the possibility for a person to merge the outlines of his body or any selected part of his body with another virtual body, which gives the opportunity to interact, touch or capture objects that does not exist in reality. It is found in abundance in museums and educational scientific centers, and is now being used in the computer course and its maintenance.
9.11.2. Highlight site: The digital media provides users with smartphones or mobile devices with GPS positioning.
9.11.3. Projection: It is one of the most common and used types of augmented reality. It depends on the use of artificial images and projecting them onto the actual reality to increase the percentage of details that the individual sees through devices. This type is distinguished by the possibility of communication between users synchronous and asynchronously through augmented reality environment.
9.11.4. Vision: Provide users with digital media after a certain thing is photographed by the mobile phone camera or portable smart devices so that the camera can capture and distinguish it to display the related information.
9.11.5. Shapes Recognition: This type is based on the principle of recognizing the shape by recognizing the angles, borders, and curves of a specific type such as the face or the body to provide additional virtual information to the body in front of it in physical reality.

9.12. Concurrent and Asynchronous Communication Patterns over the Internet
After the emergence of the Internet and its use in the educational field, the form, and style of this use has evolved from general use in the tasks of searching for information and entertainment, communicating with others, to shifting and focusing on educational buildings, societies, and entire educational environments that exist in their entirety on the Internet.
First: The Synchronous communication mode over the Internet:

The term "synchronous" is taken from the ancient Greek word "SIHN-kro-nuhs" and as such is made up of two main syllables:

a. The "syn" meaning is "with" or "with"

b. The word "Chronous" means "time" meaning "time" and it is grouped meaning "the same time" and it is an adjective describing an object or event in the order of the same time as it occurs at the same rate and exactly over time (Denis Howe, 2007,18). Synchronized communication through augmented reality through a three-dimensional virtual classroom that supports simultaneous learning and collaborative work where learners can communicate through text chat or voice recording within a virtual environment where each learner has his personality to speak, interact and participate in a virtual environment 3D graphics. It is also evident in virtual science labs and virtual computer labs, where experiments are conducted using augmented reality, which enhances collaborative learning sessions in this synchronized virtual environment. Moreover, study groups can learn to change the role between the moderator and the participants in the simultaneous virtual setting (Heike Hufnagel & Mareike Geisen, 2007,78). It is also evident in virtual science labs and virtual computer labs, where experiments are conducted using augmented reality, which enhances collaborative learning sessions in this synchronized virtual environment. Moreover, study groups can learn to change the role between the moderator and the participants in the simultaneous virtual setting (Heike Hufnagel & Mareike Geisen, 2007,78).

A. 3D Synchronous Messaging System

Real-time comments are important to facilitate discussions, and simultaneous communication systems are very effective in monitoring student progress as well as in the provision of appropriate academic support. An example of the use of a three-dimensional concurrent educational correspondence system in learning mathematics has been shown that students learn better mathematical concepts and processes when they see step by step solutions in Simultaneous discussions using the graphical environment. These systems were used during the first semester, in the academic year 2003-2004, at a university in the Philippines and proved to be very effective in fostering the interaction between students and the college in which they study. It is important to note that most of these systems are available free of charge by downloading from the Internet (Luisa D. MARIANO, Nikki Philline C. DE LA ROSA, 2004,89).

B. Live Discussion System via 3D Virtual Environments

The system of direct chat rooms over the Internet was developed by (Jarkko Oikarinen) in Finland in 1988. The IRC was designed in the form of a program (server - terminal), so the user runs the "terminal" program from a computer and then through the Internet. The program (server) not working on the user's device, and there are currently hundreds of services on the Internet dedicated to direct dialogue on the Internet, and those connected, passing their data through programs (terminals) to their users, and there are many sites for three-dimensional conversation where chats are inside rooms designed to immerse the user. In a 3D augmented virtual environment, for example, but not limited to www.habbo.com & www.imvu.com. Many of the three-dimensional conversation websites provide educational virtual environments by designing educational rooms and virtual classrooms in addition to educational laboratories (Nicoletta Di Blas, Caterina Poggi, 2007,133).
C. Synchronous Online Augmented Reality Conferences

In augmented reality conferences, the three-dimensional images, the augmented reality environment, and the various applications make the user an active participant, not only an inactive receiver of the receiving media and the simultaneous interaction in the augmented reality environment makes the user work within a collaborative teamwork environment. The synchronous augmented reality conferences made the user more interactive and active within. This is the environment in which the user is immersed, and feels as he is in a real environment in which he practices his activity like speech, and movement (Jones, R., Lou, J., Yeung, L., V., Lai., Man, C., & Woo, B, 2001). In Figure (4), an explanation of the method of interaction within synchronous conferences is as follows:

Second: The Asynchronous Communication Pattern over the Internet

Asynchronous is taken from the ancient Greek "ay-SIHN-kro-nuhs" and as such consists of two main syllables:
First: The syllable "asyn-" which means "not with" meaning "not with".

Second: The syllable "Chronous", which means "Time", meaning "time," which is grouped, which means "the difference of time", which is an adjective describing things or events in a time-difference pattern.

Definition of asynchronous communication pattern:
In the field of computer programs, "asynchronous operation" means the process that operates independently from the rest of the operations. In the educational field, using asynchronous availability, "means stored and archived means classified in the form of files, web pages, CDs, e-mail, fax, and tapes. Video Thus, this type has many advantages:

Flexibility: It refers to the ability to learn to access the lesson from school or home and in the asynchronous connection: the connection is through the late transfer of information that is stored or archived, and then the learner enters and then receives the information.

A. Asynchronous Messaging Systems
These systems are also available free on the Internet and are very useful in education. It was used in mathematics where the EGroup app was used for Yahoo and EGroup was similar to IVLE for the Integrated Virtual Learning Environment (Luisa D. MARIANO, Nikki Philline C. DE LA ROSA, 2004,89).

B. Web Forums
Also known as the function of the multiple threads of conversation, online forums are established as a way to support collaborative learning between individuals. Forums fall under the category of computer-based asynchronous communication tools and provide the opportunity for individuals to send their comments or questions. The use of discussion and discussion forums is increasing, and Internet-based forums are considered among the communication systems that support transmission models (multiple/multiple), and the number of researchers and scholars are producing models to measure and analyze the network dialogue (Campos, M. A Construtivist, 2004, 29).

C. Discussion Board
Discussion board as a term means that if one individual sends a question, and three other individuals send the answer to this question; these four messages include what are called "Threads and Threaded Discussion Board". Through the discussion board, they can be employed in many educational strategies, including Discussion boards, discussion forms, the news board, the Bulletin boards, the message boards, and it is unlike the direct dialogue or what is called the chat session, as the dialogue forum is a discussion between individuals with a fixed or discussion over time.

Third: Method and procedures:
Given that the current research aims to know the effect of different patterns of augmented reality communication in three-dimensional e-learning environments to improve the skills performance of students of the College of Computer Science at Jazan University and their academic achievement, so the researchers followed the following procedures:

A. Preparing the Tutorial
After examining the two researchers on more than one model for designing education, such as the Alessi & Trollip model (Alessi & Trollip, 2000), as well as the Dick & Carey (1996) model, Katia & Mary (1999) and the SLN model (SLN, 1999). From the Arab models, there are many different models for how to implement an educational design, but in their entirety, they stem from the “ADDIE” model, which is an abbreviation of five names for the five stages as shown in the figure Analysis, Design, Development, Implementation, Evaluation. Each stage has its output, which is considered the entrance to the next stage.
(Table 2) The general design model consisted of five stages, as shown in the following table:

<table>
<thead>
<tr>
<th>Analysis</th>
<th>Design</th>
<th>Develop</th>
<th>Implement</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine the educational needs and obstacles and the characteristics of the trainees</td>
<td>Determine the educational and technical specifications of the educational program</td>
<td>Transforming the design into a program that meets the needs of the learners</td>
<td>Conducting the education process</td>
<td>Evaluation of the effectiveness of the educational program And determine the extent of its efficiency</td>
</tr>
</tbody>
</table>

In the following, the researcher explains each of the five stages:

A.1. **Analysis Phase:**

The analysis stage is the first and most important stage of building an electronic educational program, as it is the basic step upon which the rest of the steps are built and the researchers explain to them as follows:

A.1.1. **Needs Assessment:**

Needs are the set of changes required to be brought about in an individual related to his knowledge, skills, experiences, behavior, and attitudes (Kamal Yunus, 2006, 215). At this stage, the learners' needs in the subject of computer are identified and maintained.

A.1.2. **Identifying the constraints:**

Obstacles are what stand in the way of conducting educational programs in any educational institution, whether due to spatial, material, or temporal conditions.

A.1.3. **Determine the learners' previous experiences:**

The two researchers conducted a set of personal interviews with the learners to determine their previous experiences and their knowledge of maintaining educational devices and computers, to determine the possibility of dealing with AR technology.

A.1.4. **Determining the general and procedural objectives of the educational program:**

The process of setting goals is considered one of the important steps when preparing training or educational lessons, as it is the starting point on which the educational content is developed, as well as the endpoint where the achievement of those goals is measured at the end of the educational process and is an indicator of its success or not. Framework for setting goals with the following: Preparing a list of goals to be achieved through the use of augmented reality. The goals were limited to the following:

- Identify what augmented reality is
- Preparing a session to present the educational content.
- Improving the educational process by employing augmented reality in it.
- Exploiting all that augmented reality technology can provide in the educational lesson.

To measure the goals, it was necessary to formulate them in the form of phrases describing the performance expected of each learner after completing the educational program, which is known as behavioral or procedural goals, so the researchers prepared a list of objectives for the content of the educational program as follows:

B. **Design Phase:**

This stage includes determining the educational and technical specifications of the educational program based on the outputs of the previous analysis stage, which are as follows:
C. Development Phase:
In this phase, the design is transformed into an "educational program" product that meets the learners' needs.

D. Evaluation Phase:
The researchers made sure, before starting the application, to test the created program, to ensure that the session was sound so that all members of the research group could access it.

Fourth: Preparing research tools

A. Achievement Test (Preparation and Adjustment):
The two researchers carried out the following procedures to prepare the achievement test.
A.1. Determining the goal of the achievement test
A.2. Determine the type of test and its vocabulary
A.3. Develop test instructions
A.4. Preparing the test in its initial form
A.5. Set the achievement test:

To adjust the achievement test, the two researchers performed the following steps.
- Ensure the validity of the test.
- Calculate the test stability.
- Calculation of the corrected ease factor from the guesswork effect of each of the test items.
- Calculating the correlation coefficient between the upper ease factor and the lower ease factor for each question separately, using the “Flanagan” table.

B. Skill Scorecard (build - set):
This card aims to identify the extent to which educational technology students have acquired the necessary technical skills in the course of computer use and maintenance.

B.1. Building a Scorecard:
The researchers performed the following procedures to construct the notecard.
B.1.1. Determining the general objective of the notecard.
B.1.2. Validate the performance note card.
B.1.3. Stability of the scorecard.

B.2. Implementation and Evaluation Stage:
This stage includes the "ADDIE Implementation Model".
B.2.1. The implementation of the pilot experiment.
B.2.2. Basic Implementation experience.

Fifth: Research Results:
The two researchers used the torsion factor to identify the significance of the differences between groups in the pre-test scores, and the following table (3) illustrates the results of this analysis.

Table (3) Calculating the torsion coefficient to ensure the consistency of the research sample in the pre-academic test.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Number of the sample</th>
<th>Average</th>
<th>Standard Deviation</th>
<th>Mediator</th>
<th>Coefficient of Torsion</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Group</td>
<td>13</td>
<td>30.1</td>
<td>2.7</td>
<td>30.0</td>
<td>0.4</td>
</tr>
<tr>
<td>Second Group</td>
<td>13</td>
<td>30.1</td>
<td>2.7</td>
<td>30.0</td>
<td>0.4</td>
</tr>
<tr>
<td>Third Group</td>
<td>13</td>
<td>30.7</td>
<td>3.8</td>
<td>30.0</td>
<td>0.6</td>
</tr>
</tbody>
</table>
The results of the statistical treatment, as shown in the previous table, indicated that the skew coefficient ranges between ±1. This indicates the homogeneity of the research sample in terms of academic achievement. As for the skill performance, the researchers used the Levan test, and the test result showed the homogeneity of the research sample, as there are no statistically significant differences between the groups regarding the degrees of pre-skill performance. The torsion coefficient was also used to identify the significance of the differences between groups in the pre-test. Table No. (4) below shows the results of this analysis:

Table (4) Calculating the torsion coefficient to ensure the homogeneity of the research sample in the pre-skill performance

<table>
<thead>
<tr>
<th>Sample</th>
<th>Number of the sample</th>
<th>Average</th>
<th>Standard Deviation</th>
<th>Mediator</th>
<th>Coefficient of Torsion</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Group</td>
<td>13</td>
<td>64.2</td>
<td>5.7</td>
<td>65.0</td>
<td>-0.1</td>
</tr>
<tr>
<td>Second Group</td>
<td>13</td>
<td>64.2</td>
<td>4.4</td>
<td>63.0</td>
<td>0.9</td>
</tr>
<tr>
<td>Third Group</td>
<td>13</td>
<td>64.8</td>
<td>5.4</td>
<td>66.0</td>
<td>-0.4</td>
</tr>
</tbody>
</table>

The results of the statistical treatment, as shown in the previous table, indicated that the skew coefficient ranges between ±1. This indicates the homogeneity of the members of the research sample in the aspect of skill performance.

A. Presenting the Results of Academic Achievement:

The unidirectional method of analysis of variance was used to identify the significance of the differences between groups regarding academic achievement between the three experimental groups in addition to measuring the main effect of the independent variables on the dependent variables. Table (5) illustrates this analysis.

Table (5) One-way analysis of variance (ANOVA) using LSD Test

<table>
<thead>
<tr>
<th>Study variables</th>
<th>Synchronous connection mode</th>
<th>Asynchronous connection mode</th>
<th>Both Modes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average ± standard deviation</td>
<td>Before</td>
<td>After</td>
<td>Before</td>
</tr>
<tr>
<td>Average relative change (Earning degree)</td>
<td>1, 30 ± 7, 2</td>
<td>33 ± 5 and 2*</td>
<td>9, 30 ± 8, 3</td>
</tr>
<tr>
<td>10.5% ↑</td>
<td>10% ↑</td>
<td>22.3% ↑</td>
<td></td>
</tr>
</tbody>
</table>

It is clear to us from the previous Table (5) the significance of the differences in the achievement test for the variable of the synchronous and asynchronous communication type, and both types between the pre and post-measurement are statistically significant at the level (0.05) * within the groups; The significance of the differences between the variable of the synchronous communication style and the pattern of the asynchronous communication is not statistically significant at the level (0.05) #; The significance of the differences between the variable of the simultaneous communication style and both types are statistically significant at the level (0.05); The significance of the differences between the variable of the asynchronous communication style and both types are statistically significant at the level of (0.05) §; Mean ± standard deviation; mean percent change.
The First Assumption:

It states: "There are statistically significant differences at the level of (0.05) between the mean achievement of the experimental groups for research due to the basic effect of the communication pattern with augmented reality technology in favor of the group that combines the two types of simultaneous and asynchronous communication." By extrapolating the results in Table (5), it becomes clear that there are statistically significant differences at the level (0.05) for the variables of the communication patterns in the post-measurement of the achievement test were within the group that used the simultaneous communication pattern. There is a statistically significant difference at the level of (0.05) for the variables of communication patterns in the post-measurement of the achievement test, which were within the group that used the asynchronous communication pattern. The researcher referred to this with the sign # inside the previous table, and it was also evident that there is a statistically significant difference at the level of (0.05) for the variables of the communication patterns in the post-measurement of the achievement test. Thus, the first hypothesis is accepted, which states: There are statistically significant differences at the level of (0.05) between the achievement of the experimental groups for the research due to the basic effect of the communication pattern with augmented reality technology in favor of the group that combines the two types of synchronous and asynchronous communication.

Interpretation of results of academic achievement:

The results of the first hypothesis on academic achievement can be interpreted as follows:

First Assignment:

"There are statistically significant differences at the level of (0.05) between the mean achievement of the experimental groups for research due to the basic effect of the communication pattern with augmented reality technology in favor of the group that combines the two types of simultaneous and asynchronous communication." This result is consistent with the study (Al-Jawhara Ali Al-Dahasi, 2017) using augmented reality technology in developing mathematical thinking skills, as the study aimed to identify the role of augmented reality technology in teaching mathematics, where the study sample consisted of (120) primary school mathematics teachers in Dammam. The results of the study were positive for the use of augmented reality technology in teaching mathematics as it helps to gain familiarity with the subject matter and helps to increase students' cognitive abilities and helps to take into account the individual differences between students. This result is consistent with the study (Abdul Raouf Muhammad Ismail, 2016) “The effectiveness of using projective and planned augmented reality in developing the academic achievement of the computer networks course among educational technology students and their motivation in investigation activities and their attitudes towards this technology.” This study found statistically significant differences in students' achievement scores. The study sample in learning computer networks is attributed to the teaching method and in favor of augmented reality technology, with its two types, projective and planned, in levels of achievement. This result is consistent with the study (Amal Ibrahim Hamada, 2017) “The effect of using augmented reality applications on mobile devices on developing the achievement and creative thinking skills of fourth-grade students.” The results of this study concluded that there is a statistically significant difference at the level of significance (0.05) between the main scores of the students of the first experimental group in the pre and post applications of the cognitive achievement test related to the science decision and the creative thinking scale in favor of the post-application.

Presenting the results of skill performance:

The one-way method of analysis of variance was used to identify the significance of the differences between groups for the skill performance between the three experimental groups in addition to measuring the main effect of the independent variables on the dependent variables. Table (6) illustrates this analysis:
It is clear to us from the above Table No. (6) the significance of the differences in the skill performance of the variable of synchronous and asynchronous communication style, and both types between the pre and post-measurement are statistically significant at the level of (0.05) within the groups *. As for the significance of the differences between the variable of the synchronous communication style and the pattern of the asynchronous communication, it is not statistically significant at the level (0.05). The significance of the differences between the variable of the simultaneous communication style and both types are statistically significant at the level of (0.05). The significance of the differences between the variable of the asynchronous communication style and both types are statistically significant at the level of (0.05) §; Main ± standard deviation.

The Second Assumption:

There are statistically significant differences at the level of (0.05) between the average skill performance of the experimental groups for the research due to the basic effect of the communication pattern on virtual reality systems in favor of the group that combines the two types of synchronous and asynchronous communication. By extrapolating the results in Table (6), it becomes clear that there is a statistically significant difference at the level of (0.05) for the variables of communication patterns in the post-measurement of skill performance. They were within the group that used the simultaneous communication style. (0.05) for variables of communication patterns in the dimensional measurement of the skill performance note card were within the group that used the asynchronous communication pattern. The researchers referred to this with the sign # in the previous table, and it became clear that there is a statistically significant difference at the level of (0.05) for the variables of communication patterns in the post-measurement of skillful performance. They were within the group that used both types of synchronous and asynchronous communication patterns. Thus the second hypothesis is accepted, which states: There is a statistically significant difference at the level (0.05) between the average skill performance of the experimental groups for the research due to the basic effect of the communication pattern with augmented reality technology in favor of the group that combines the two types of simultaneous and asynchronous communication.

This result is consistent with the study Souza-Concilio and Pacheco (2013), which showed that augmented reality technology is important in the teaching and learning process because of its effective role in facilitating the understanding of complex topics, providing greater content retention, and increasing learners' motivation. This result is consistent with the study (Mat-jizat, J, Osman, Yahaya and Samsudin, 2016) and the study (Klopfer and Squire, 2008), which concluded that the use of augmented reality in the educational process plays an effective role in improving learners’ perception and interaction with educational content and understanding. The deeper information and promotion of creative thinking also helps to create educational activities that support teaching and learning and achieve its educational objectives.

10. RESEARCH RECOMMENDATIONS

a. The necessity of making use of modern technology and its applications, such as augmented reality technology, in teaching the computer course to other college students and other subjects.
b. Paying attention to improve the skills of the students and teachers in the Faculties of Education to enable them to deal with the changes in the current era.
c. Expanding the use of augmented reality technology and making use of modern applications such as the (Anatomy 4D) application and the (Aursama) application on mobile devices.
d. Holding training courses for faculty members at Jazan University to train them in the use of augmented reality technology.

11. RESEARCH PROPOSAL
a. Conducting more studies and research to study the impact of augmented reality technology in improving the educational process.
b. Studying the possibility of using augmented reality technology in other courses.
c. Study the effect of different augmented reality strategies to improve thinking skills.

12. CONCLUSION
Current search target to improve the technical skills and academic achievement of the students in computer sciences using Augmented Reality environments with Synchronous and Asynchronous communication patterns and research came out with a set of results, the most important of which was - there is a statistically significant difference at the level of (0.05) between the main achievement of the experimental groups for the research. Due to the basic effect of the communication pattern with augmented reality technology for the benefit of the group that combines the two types; synchronous and asynchronous communication, and there is a statistically significant difference at the level of (0.05) among the average skill performance of the experimental groups for the research is due to the basic effect of the communication pattern with augmented reality technology in favor of the group that combines the two types of synchronous and asynchronous communication.

REFERENCES


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