A Rapid Review of Learning using Hologram in Higher Education

https://doi.org/10.3991/ijet.v18i12.38913

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Abstract—Traditional learning is the base of any learning system but there are some issues to be considered such as attracting learners' attention and make them learn more. Higher education needs to deploy innovation teaching methods to improve learners' interactivity with lessons, catch the students' attention and enhance the overall learning process. Holographic technology might change the way of creation and sharing knowledge. Using Holographic Technology in learning is still new to the education industry but it has the potential to revolutionize aspects of teaching and learning experience. One of the most recent improvements in educational system is the introduction of mixed reality holograms, which is a platform combining augmented and virtual reality to provide a real-world experience with virtual objects. In this paper, the researchers present basic concepts about Holographic Technology, in order to understand the importance of this technology in our life and whether learners would perceive this technology positively. The researchers identifying the strengths and weaknesses of Holographic Technology as a teaching tool, in order to evaluate its effectiveness in higher educational system and whether it helps in the enhancement of the teaching-learning process and recommend the educational institutes to start make some changes to accommodate the Hologram Technology.

Keywords—Holographic, education, higher, Hologram, technology

1 Introduction

The rapid development in Information and Communication Technology (ICT) has made a lot of changes in many fields one of them is the field of education. ICT in education produced new models namely: e-Learning, distance learning and blended learning. These models have made an observable change in the educational process by integrating the technology with learning and improving the educational process.

Students nowadays are experienced with handling many technological devices, such as computers, smartphones and tablets. However, the introduction of more modern visualization technologies, such as augmented and virtual reality which offers additional tools for educators wishing to provide engaging 3D content for students.

Holography is the science of making holograms which are usually proposed for displaying three dimensional (3D) images in a two-dimensional surface reproduced from

interference pattern recorded by light beams [1][2]. The image can be viewed from any angle, so as the user walks around the display, the object appears to move and shift realistically.

The 3D Images are recorded using a laser and then restored as precisely as possible to match the original image. When lightened via a laser or displayed in a darkened room, holograms are able to show absolutely precise, three dimensional images of real object and duplicate its features. You don't even have to wear special glasses to see the 3D images.

Holographic technology is starting to impact our lives and is used in a variety of ways, across several industries such as telecommunication, education, marketing and music. Medical students are now being taught using life-like holograms also the entertainment industry has used holograms and mobile gaming.

A hologram possesses a recorded picture as if it were a real object in 3D image so the students have many advantages of seeing components in it from any angle and allowing them to walk around the scene and the actual size of the image may help and encourage students to learn [3]. Hologram might support the learning process and change the way students learn and it will enhance the teaching-learning process.

The article is organized as follows: section 2 provides background knowledge to understand holography, section 3 talks about using hologram technology in teaching, followed by section 4 which talks about the effectiveness and weakness of holograph technology in learning. At the end is the conclusion and references.

2 Literature review

Holographic is a new technology that will change how we view things and it will have great effects on all fields of life especially education and science. Many researchers discussed this technology in different ways.

In 2019 Mavrikios and other researchers connected remotely a team of engineers with a team of students in a classroom and worked together in a common project using a hologram technology to deliver educational contents to the classroom. The interaction was possible by tablets and mobile devices. This research gave a delivery mechanism that it allowed for simultaneous visualization of 3D models from a group of students sitting at the classroom side [4].

In 2020 Moro and other researchers found that shifting education from traditional lectures to more self-paced, visual methods of learning will improve the education in health sciences and medicine by using devices that are already available for the general public such as Microsoft's HoloLens [5].

Abdelhamid [6] Found that Hologram can be used to increase the interaction in the distance learning programs to reinforce the professional skills of students and achieve the maximum benefits for them.

Other researchers [7,8] concluded that the Hologram Technology could be meaningful in the teaching-learning process and is important for students. it can help students improve their perceptions so that they have a better understanding. Ramlie et al. [9] showed that use of holograms as a tutor to substitute the real teacher can help in

attracting students attention and deliver information more effectively in an innovative way than that of the traditional approach.

Holography can be used as a procedure to train young children and adults to elicit scene changes from a holographic stereogram, then educators, researchers and instructional designers must continue to assess how holography performs as a learning tool and begin refinements based on those considerations [10].

3 Hologram technology concepts and technique

Gabor [11], who invented holography in 1947, introduced the term Holography which is one of photography methods and visualization tool that intended for displaying three dimensional images [12], formed by light beams from coherent light like laser light which is created with holographic projection [13]. Holograms allow the viewer to see different perspectives of a reconstructed 3D object from different angles and locations without having to use additional equipment.

The idea behind holograms is that 3D objects are recorded with a laser and then reestablished using a laser to match the original recorded image. When it is lighted with a laser, holograms can duplicate 3D features and clone the same object as the original.

Hologram has two main steps: step 1 is writing the hologram which involves recording the information then step 2 is reading the hologram, in which the hologram is illuminated with reference field similar to that in step 1 that can be done digitally [14].

The way a hologram operates is by creating the illusion of three-dimensional imagery. A light source is projected onto the surface of an object and scattered. A second light illuminates the object to create interference between both sources. Essentially, the two light sources interact with each other and cause diffraction, which appears as a 3D image, as shown in Figure 1[13].

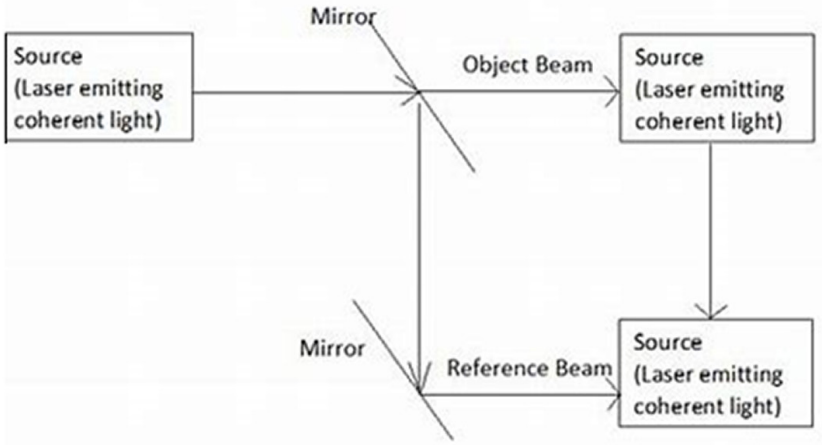

Fig. 1. A diagram of the hologram

4 Hologram technology in teaching and learning environment

The education process has to adopt the latest technology in order to create an interactive learning experience. Table 1 shows some applications and how we can invest Hologram technology in education process in higher education.

Table 1. Hologram applications in higher education

Application	Advantage	Example
Remote Instructor	Holograms can have experts illustrating or explaining critical topics live, in-person, in 3D.	– surgeon can demonstrate a surgical procedure to medical students live. – engineers can demonstrate engine features.
Connect geographically scattered classrooms	Hologram remove geographical boundaries between students.	– A classroom of Arabic speaking students can interact with a classroom of English speaking students by engaging in real-conversations and 3D show-and-tell learning.
Learning by being "in there"	Hologram can transport the students to a remote location (virtually though!).	A classroom in Jordan can interact with different scenes in the world.
Interactive and immersive educational content	Hologram can be developed as per our imagination.	Educators can use their creative skills to bring the content to life.
Revisiting history	Hologram can truly recreate events.	Simulations can recreate important historical events.

A Hologram is a new trend in education process and it has a lot of advantages for instructors and students which can revolutionize education and it has many important advantages such as:

Holography has the capability to reproduce reality which is an amazing way to motivate students.

1. Offers a truly visual and interactive learning experience to students.
2. Enables easy understanding and better retention.
3. Enables students to visualize and experience the learning content.
4. Brings together learners who are in different locations.
5. Educators can teach multiple classrooms simultaneously.

Hologram technology will break down the limitations of traditional teaching by creating an interactive experience that benefits both students and academics, also it will provide greater flexibility for academics by enabling them to continue teaching whilst travelling and invite global leaders or influencers from industry to give talks to students, therefore enriching the learning experience.

Teachers need to be trained on how to deliver holographic lectures but it can't be done as one-person work. A professional media team must support and involve to set up of holograms.

Integrated Hologram technology in education process in higher education system may face some challenges such as:

1. High cost for equipment and development.
2. High internet speed.
3. Lack of experience and knowledge about Holographic Technology in the field of instructors and teachers and how to develop it.
4. Fear of that possibly teachers can be replaced by Hologram.
5. Non-technologists may face difficulty in using the Hologram tools.

5 Conclusion

Education is one of the most important areas of life that is affected by the development of ICT. Holographic projection is the new wave of technology that will change how we view things and it will have great effects on all fields of life including education.

The hologram is very important in the field of education. This is due to the students' capability to view the concepts and visualize them during class. This will help them to clarify the concepts in a better manner and improve the learning method. When the concepts are showcased in front of students' eyes, then they can easily understand concepts very easily.

This paper focuses on the level of effectiveness of Holographic projection as a new tool which could support learning process in higher education system by studying and analyzing the feasibility of using the 3D Hologram technology in education.

The research concludes that holography will enhance teaching learning process in the future but there are many challenges that may delay the integration of holography into learning Process. Holography is very expensive to implement and needs high skills that may not be found in teachers to construct the hologram.

To take the advantage of Holograms, the educational institutes need some changes in classroom to accommodate the implementation of Holograms, develop the internet speed, give training to teachers and the teacher must accept this new form of technology. Finally, the researches in holograms must focus on the design principles that can further enhance its effectiveness in the teaching and learning process.

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Article submitted 2023-02-16. Resubmitted 2023-03-22. Final acceptance 2023-03-22. Final version published as submitted by the authors.