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Hologram Tutor: The 3D Visualization Technology Revolution in Education

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Abstract
The rapid evolution of technological tools continues to support the development of multimedia materials, particularly in the production of 3D visualizations. Multimedia materials, such as 3D visualization, have begun to be used in education because they are very beneficial in teaching and learning sessions, whether through distance education or face to face. As a result, from the era of Education 1.0 to Education 4.0, the learning method has gone through several significant stages of revolution in tandem with the advancement of technological tools produced. Various technological tools, such as stereoscopic, autostereoscopic, and hologram 3D visualization, have been developed to effectively convey learning information. However, every application of cutting-edge technology in the field of education must include elements and a careful development process to ensure optimal usability.
Keywords: Education Technology, Hologram, 3D Visualization, Education 4.0, Technology Revolution

Introduction

Education is an essential aspect of daily life. Beginning with early childhood education and ending with higher education institutions. In the field of Education, the most important aspect to emphasize is the efficient delivery of information. Consequently, various methods have been implemented and innovated periodically. In addition to effectively conveying messages, the various learning methods implemented aim to maintain students' interest and motivation throughout the process of information delivery. Therefore, each aspect of the learning tools and materials must be thoroughly examined to ensure their effectiveness. This is because every new tool and instructional resource has the potential to disrupt the process of information delivery if the developer does not follow the correct procedure and test its effectiveness.

In an effort to improve the efficacy of technology tools as classroom teaching aids, a variety of technology tools have been developed in accordance with their intended use. However, every emerging and innovative technology tool must undergo extensive testing to ensure its usability and ability to positively impact students. Consequently, the purpose of this literature review is to:

i. Determine the factors that promote the use of a technological tool as a teaching aid.
ii. Determine the fundamental elements that contribute to the technological revolution in the field of education in each era.

Revolution in Education

The technological revolution has significantly influenced changes in many aspects of life, including education. The use of multimedia materials in learning sessions has numerous benefits, particularly in attracting students'attention in the classroom (Barkhaya & Halim, 2017; Sipka, 2016; Taylor et al., 2007). The use of cutting-edge technological materials has also improved learning habits, and the education system is undergoing a transformation in which textbooks are being replaced with moving images (Unsworth, 2004). As a result, learning has taken a completely different path than we had anticipated. This is now evident as a result of the widespread use of new multimedia materials in the learning process. This advancement contributes to the primary goal of education, which is to provide students with more effective knowledge and skills. Researchers and educators in schools and institutions of higher learning welcome this situation since it allows them to maximize the use of cutting-edge technology in their teaching and learning processes. Human daily activities have also been transformed by technological innovation, particularly in the service sector, and teaching and learning activities have been facilitated (Brown, 2015). Nowadays, there is a rapidly expanding use of technology in the education industry (EdTech), this technological advances in education are used for learning systems such as distance education (Weidlich & Bastiaens, 2018), as well as to attract students and convey information more effectively.

Technological advances were a major factor in the transformation of the educational system, where the printing press was first used in 1400 (Marciniak, 2010). The use of electronic telegraphs in the 1800s (Arceneaux, 2019) was followed by wireless radio between 1800 and 1900 (Paxman, 2018). The introduction of television in 1920 (Mikos, 2019) and computers in 1940 (Kislov, 2019) has increased the use of technology in the educational system, along with the use of the internet, which began around 1960 (Leiner et al., 2009) and was followed by the widespread use of websites around 1990 (French & Shim, 2016).

Every industrial revolution has been influenced by technological advancements from previous eras. For example, technological advances in the first and second industrial revolutions influenced the third industrial revolution, where machines were introduced in the form of computers, invented new methods, and were able to channel information more quickly to the world of work, including teaching and learning (Johal et al., 2018). Opportunities to improve teaching and learning through simulation methods for complex, time-consuming, and dangerous teaching are also possible with this computer technology revolution (Buckenmeyer, 2010). To this day, the technological gadget revolution continues to evolve and improve with more creative and innovative applications, such as the existence of holograms, smartphone software, and so on. Nowadays, the presence of technological tools such as holograms is used not only to facilitate a job, but also to enhance the experience and attract students to a learning session.

Education 1.0 is an instructional approach that includes the elements of Receiving, Responding, and Regurgitating (Gerstein, 2014). Through these elements, students will 'receive' the learning information presented by the instructor, 'respond' by noting the information, reading the text and doing the same paper, and finally 'reuse' by doing more or less the same task to use. as a measure of student learning performance. This era's learning method is face-to-face, with no involvement of technological media during the learning process. Education 1.0 is also known as 'sage on the stage', which means that students learn passively by simply receiving information from the instructor (McWilliam, 2009). However, students are given limited opportunities to develop the value of their creativity. In contrast to the open learning process, students only perform tasks based on the needs of the instructor (Gerstein, 2014). There are tools created to support the student learning process in this era of 1.0 education, such as e-books in websites for more information, but there is less interaction between students and online content. In this era of education 1.0, virtual learning is also being introduced, as educators improve face-to-face learning methods by incorporating the use of websites. However this system is very limited for each institution (Demartini & Benussi, 2017). Thus, in addition to libraries and news channels, the teaching force was the primary source of knowledge during the 1.0 education era, and the classroom has traditionally been the primary place of learning.

In the education 2.0 industry, the instructional approach is viewed as less effective (Gerstein, 2014). As a result, in the era of education 2.0, educators began to implement the constructivism approach. Interactions between users and activities in Education 2.0 include elements such as communicating, contributing, collaborating, and co-creating (Gerstein, 2014). As a result, educators began to look for ways to improve students' learning processes and to promote interactive values by encouraging students to interact with peers and seek their own knowledge as students learned from one another.

Technology was also used to improve traditional approaches to learning in Education 2.0. Following this approach, open source information and education platforms such as wikis, personal websites, blogs, and social media were developed, resulting in collaboration, social learning, and learning sharing. The use of such technology is also consistent with learning structures that adhere to the principles of active, experiential, authentic, relevant, and sociable learning (Gerstein, 2014). The flipped classroom method is a technique used in education system 2.0 that combines learning in the real and virtual worlds (Kurup & Hersey, 2013).

The internet's existence is a major factor of development in the education industry. Education 3.0 brings about more changes than the previous educational era. Technology platforms were introduced, and teachers' roles were transformed into facilitators (Gerstein, 2014). With the availability of a virtual platform, students can choose the subjects they want to learn and set their own learning objectives while being guided by the teacher. In the education 3.0 era, more emphasis is placed on learning methods that connect people from all over the world to share knowledge and create new knowledge (Gerstein, 2014; Watson et al., 2015). Since the 20th century, interactive whiteboards have largely replaced traditional whiteboards (Tan et al., 2018). This era describes the digital age, when students began to learn on computers. Several platforms are being used as alternatives to student learning (Wang et al., 2012). Students can study whenever and wherever they want by using an open platform like this. Students are also actively involved in the learning process as they begin to interact with their peers in order to learn more.

Industry-wide implementation of a large-scale cyber physical system is the fourth industrial revolution (IR4.0). It is also said to be a combination of existing and new technologies; in fact, this 4.0 industrial revolution is said to bring more significant changes than the previous one (Halili, 2019). Increasing demand for skills in other industries also contributed to change and ushered in the era of education 4.0. Consequently, the primary objective of the education industry is to fulfill the requirements of this industry. This is due to the fact that the 4.0 industrial revolution affected not only businesses, jobs, and people, but also education. The technological revolution in the education sector presents a one-of-a-kind opportunity to reinvent a technology to overcome the challenges of digital use today (Kalolo, 2019). Experts in education acknowledge that the proper application of digital technology can improve the teaching and learning process (Jelfs & Richardson, 2013).

In addition to enhancing the teaching and learning process, technological advancements can stimulate students' interest in using learning materials. Therefore, in order to meet the demands of the 4.0 industry revolution in education, institutions of higher education should incorporate innovative teaching and learning techniques (Halili, 2019; Shahroom & Hussin, 2018). These include adopting some of the most effective strategies, innovating with technology to create something new, and encouraging greater creativity among educators. Because the industry 4.0 revolution is not limited to the use of computers alone, especially in the education sector, educators must explore additional things that can be utilized to create a more dynamic and efficient teaching and learning system. To comprehend the instructional needs of students, a variety of additional tools and techniques may be utilized. For instance, the use of hologram technology created by combining several existing technological tools in order to convey information more effectively and engagingly (Awad & Kharbat, 2018). During the 4.0 industrial revolution, projectors, high-definition audio and video animation or recording, the Internet, and lighting-physics-producing platform structures are commonly used to create hologram technology. Various types of holograms can now be manufactured using a combination of several technological tools. Holograms have also been utilized as one of the mediums and teaching aids in the classroom due to its reputed ability to attract students and effectively convey information (Awad & Kharbat, 2018; Ramachandiran et al., 2019; Roslan & Ahmad, 2017; Walker, 2013; Wojcik, 2018).

Education 4.0 is associated with nine trends, including diverse time and place (various times), personalized learning, free choice, project-based, field experience, data interpretation, exams will completely change, student ownership, and mentoring will become increasingly important (Peter, 2017). However, four characteristics must be maintained in the use of digital technology: interactive, symbolic flexibility, interactive with diverse others, and multi sourced (Acilar, 2011). Interactive describes interactions in the digital age, including face-to-face and written conversations. The inquiry and response process can also be expedited. It includes the utilization of e-mail, blog posts, and social media. Symbolic flexibility describes the nature of multidimensional digital technologies, such as moving or static images, text, and audio, that have been made available for flexible use in a variety of educational courses. The nature of digital technologies and tools that are increasingly user-friendly, flexible, pervasive, and immediate for communication and knowledge acquisition is that they are interactive with diverse others. Multi-sourced knowledge and experience explain the nature of technology as a variety of digital information sources (Acilar, 2011).

However, these four characteristics may be changing as more technological tools are combined and educators innovate to produce the best learning methods, such as the use of holograms that are said to provide students with new experiences (Paredes & Vazquez, 2019). In actuality, the teaching staff must be prepared for a future in which the use of technology can be created in a variety of methods. Therefore, educators and researchers must move more quickly in preparation for greater industry-wide changes.

Moreover, the use of more advanced digital technology, such as computers and multimedia materials such as holograms, must be adapted to the learner-centered approach in order for it to effectively enhance the student learning experience (McKnight et al., 2016). Worries also arise when the rapid advancement of technology leaves teachers with no time to consider the consequences and efficacy of its use in the education system (Kalolo, 2019), and there are issues with teachers who are less skilled in using technology to provide students with guidance (Mailizar & Fan, 2020).

Digital Technology in Education

The advancement of digital technology is important in the education industry, especially for providing students with new experiences and improving the teaching and learning process (Estriegana et al., 2019). Future learning processes will differ from present ones. Where students can now complete their learning process in twenty-four hours based on their own preferences (Zamzuri, 2018). The same thing is also experienced by the teaching staff, who can now transmit learning information remotely without being physically present in class.

In a learning session, students must be taught how to receive information, in addition to the process of information transmission (Zamzuri, 2018). Because past and ongoing forms of education are clearly different, the use of educational software such as touch screens, new computer software, and so on has been deemed essential for attracting students' attention. The use of multimedia materials with a combination of text, graphics, video, animation, and audio as the primary elements can also have a positive effect on the information delivery process (Acar & Tarhan, 2008) because multimedia materials can be one of the stimuli for students to comprehend and accept information compared to traditional methods. However, before using such multimedia equipment and materials, research must be conducted to determine their effectiveness and capabilities (Ghuloum, 2010). Specifically, displays that are intended to convey information to students, such as animations and videos, are utilized frequently in modern classrooms.

Students may be adversely affected by the use of multimedia materials that have not been subjected to sufficient study and research. Possible adverse effects include disruption of the information reception process by students, students' difficulty in comprehending the content they wish to convey, and feelings of discomfort (Heidig et al., 2015; Heidig & Clarebout, 2011). Although the effectiveness of the use of multimedia instructional materials has been observed to trend downwards, with the aid of the most recent technological tools and research, these instructional materials can actually improve student learning performance (Beydogan & Hayran, 2015; Jeong, 2018; Simarmata et al., 2018). This clearly shows that careful consideration must be given to the development of instructional multimedia materials prior to their widespread use by students.

The method of utilizing existing multimedia materials must evolve rapidly to accommodate the ever-changing learning environment. This is important for preventing the effectiveness of its use from being compromised, particularly in terms of the usability of such multimedia materials (Oztekin et al., 2013). Various new technological tools can be utilized as a multimedia platform to enhance the effectiveness of learning sessions through creativity and innovation. Hologram technology is one of the potential technologies to be explored, and it must undergo extensive testing before it can be used.

3d Visualization Technology in Education

As technology advances, various technological multimedia tools and materials are being developed as a more effective method of presenting information to students. The use of multimedia tools and materials is fully utilized in the learning sessions, with the goal of attracting students' attention while providing a good motivational boost to the students (Sary et al., 2018). Many efforts are made to upgrade multimedia tools and materials that have the potential to be used as a medium for student learning in order to reach this aim. 3D image display is one of the multimedia materials used in the classroom as a teaching aid (Alyami et al., 2019; Orcos et al., 2019). Various methods are used to present the best 3D image display, including stereoscopic, autostereoscopic, and hologram 3D display.

A stereoscopic display is a display of two images that must be viewed separately with each eye to create the illusion of a three-dimensional object for the user (Dodgson, 2005). Stereoscopic displays necessitate greater concentration from the user, as this display method is disrupted when the user's head and eyes deviate from the set focus point.

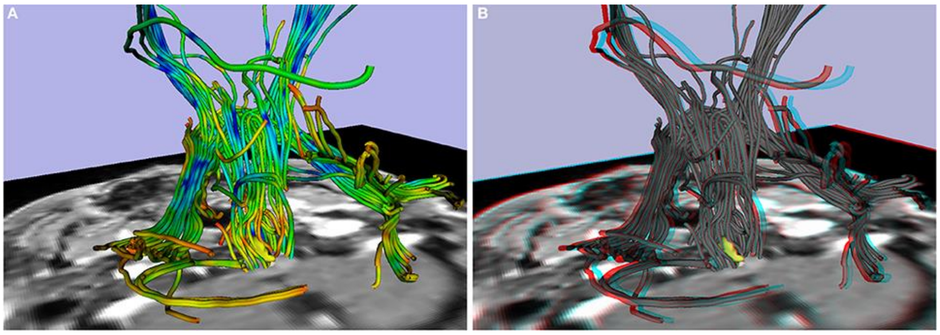

Figure 1 Example of a stereoscopic display without the use of special glasses Source: (Rojas et al., 2014)

Stereoscopic use is said to increase users' entertainment value by providing a natural feeling, a perception of sharpness, and a genuine sense of presence (Tam et al., 2011). For example, because of their ability to convey information about visual space and depth well, stereoscopic 3D visuals have been used as a teaching aid in medicine (Henn et al., 2002) and geography (Johnson et al., 2006). Its use is also said to improve comprehension and accelerate learning

(Henn et al., 2002). Although this stereoscopic display is said to improve users' understanding of space and environment (McIntire et al., 2012), its use in computer games is said to have a negative impact on users (Takatalo et al., 2011), and its use can cause a variety of problems, including eye pain, fatigue, confusion, and nausea (McIntire et al., 2012; Moorthy et al., 2013). This stereoscopic display presentation is also difficult to use widely because it necessitates the use of special glasses (Dodgson, 2005). This approach is also viewed as less appropriate for use in a learning session because the use of special tools such as glasses distracts attention and causes discomfort for some people, even if its use is limited to one individual.

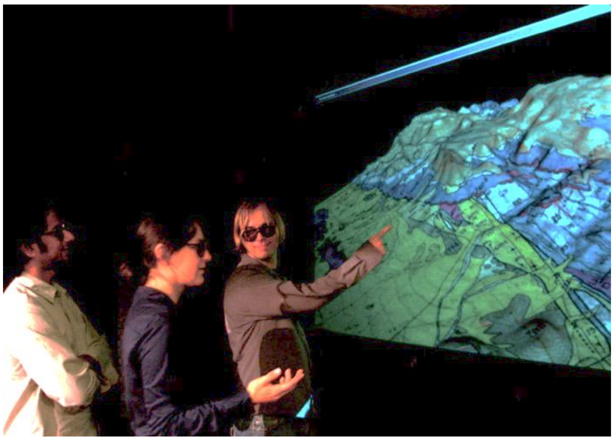

Figure 2 Stereoscopic use with special spectacles
Source: (Johnson et al., 2006)

The autostereoscopic display is more appealing to users because it can display 3D visuals without the use of special glasses (Barkowsky & Le Callet, 2010; Dodgson, 2005; Urey et al., 2011). The existence of autostereoscopic displays is a fascinating development for the entertainment and media industries. This is due to the fact that autostereoscopic technology can provide a better user experience by producing a stereo display without the use of other additional devices (Petkov, 2010). Because of its multiple views (multiview) and head-tracked detectors, this autostereoscopic display can be viewed without the use of special glasses. The results of this autostereoscopic display are said to be similar to holographic displays (Dodgson, 2005).

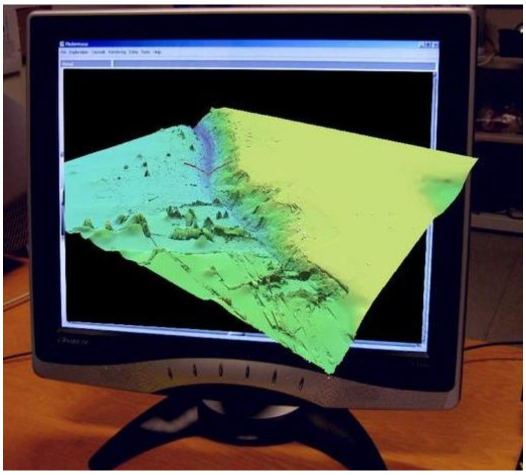

Figure 3 Autostereoscopic display using a monitor
Source: (Damm & Gotze, 2009)

However, the autostereoscopic techniques that are frequently used to attract these users involve the use of weak techniques such as low resolution and limited viewing angles. Even the use of autostereoscopic technology is said to be problematic in terms of providing a full-resolution display (Zhuang et al., 2018). Furthermore, the use of autostereoscopic requires the user to direct their gaze in two different directions (Chen et al., 2017) in order to produce a primary focus and see the 3D effect. This will give the user an earlier sense of discomfort and fatigue. If the user loses focus or watches in the wrong way, 3D visual production becomes invisible. This is referred to as crosstalk. Crosstalk is defined in stereoscopic and autostereoscopic views as the confusion of vision from one or both parts of the eye towards the other. The presence of crosstalk has a significant impact on the 3D visual quality that should be visible (Kim et al., 2017). This issue is also thought to be most prevalent in autostereoscopic use.

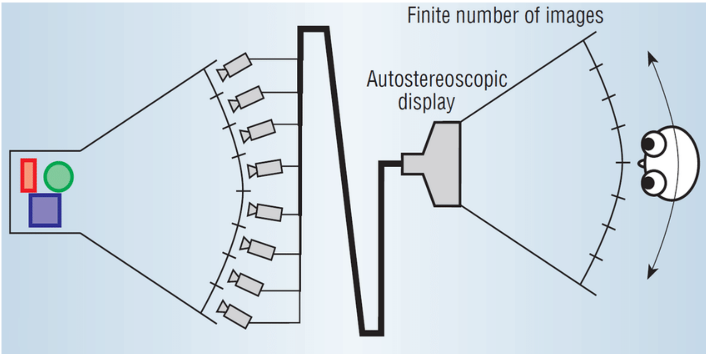

Figure 4 The concept of autostereoscopic view
Source: (Dodgson, 2005)

Because of the lack of functionality and negative effects on these two types of 3D displays, various efforts are being made to create a 3D display that is more comfortable and attracts the attention of users. One of the ongoing projects is the creation of a 3D hologram display. Many studies on 3D hologram displays have been conducted due to the potential and benefits available through their use.

Hologram Technology

Hologram displays differ from stereoscopic and autostereoscopic displays in their display. The use of holograms does not necessitate the use of specialized glasses. This makes it an appealing tool for use in applications that require real-world scenarios. Users can see a comprehensive 3D display of parallax naturally by using holograms (Hackett, 2013).

The term hologram is a combination of two words derived from the Greek terms 'holos' (whole view) and 'gram' (message), which collectively mean 'whole message' (Choi et al., 2019). Holograms can also be interpreted as a 'all-encompassing view' (Ghuloum, 2010). Pepper's ghost was the original name for the hologram. Pepper's ghost was first used in Victorian theaters throughout London in 1860, where it served to create the illusion of the audience's eyes in the cinema. However, holograms were invented in 1940 by a Hungarian scientist named Dennis Gabor using various techniques (Choi et al., 2019).

However, with new methods and technological support, the term pepper's ghost is less commonly used and has been replaced by the term hologram. This is due to the use of new technological tools such as projectors and transparent screens, which have produced high-definition displays with the necessary holographic features. As a result, many researchers and industry practitioners have used the term "hologram" in their research. The use of hologram techniques represents a new technological paradigm shift that allows us to think more creatively and innovatively. As a result, numerous efforts are made to achieve the best 3D hologram display results.

The Application of Holograms in Education

In general, several types of holograms are commonly used in the education industry. The application of these various types of holograms is usually determined by the information to be conveyed and its suitability. This is due to the fact that holograms are used in a variety of fields of learning such as medicine, geography, construction, and so on (Chaudhari et al., 2015), including the presentation of the teaching force in the form of holograms (Kelion, 2018; Walker, 2013). The use of holograms in education is one method or strategy for increasing students' understanding and attracting students' attention (Roslan & Ahmad, 2017).

As discussed in the topic of hologram types and techniques, pseudo 3D holograms are commonly used to convey information to students. The concept of light reflection onto a transparent screen is used in this type of hologram. This holographic technique that uses the reflection of light onto a transparent screen also typically uses a four-sided pyramid shape (Salih et al., 2017) to produce a display that can be seen from four different angles (Reichelt et al., 2010; Tiro et al., 2015), a three-sided pyramid shape (Bovier et al., 2017) for a three-angle view, and a one-sided rectangle (Figueiredo et al., 2014; Hong et al., 2014; Luevano et al., 2019).

Pyramid-shaped holograms are frequently used to display an object or product from all four sides (Zeng et al., 2017). Because the pyramid-shaped hologram is suitable for displaying objects or products through four sides with a 3600 degree view, it is frequently used as an advertising and exhibition medium (Chaudhari et al., 2015), and in the education industry, it is used to display objects for subjects such as biology (Gafur et al., 2019), science, technology, and engineering (Roslan & Ahmad, 2017). This is due to its display, which can be seen from different angles and can be observed by a group of people walking at random. However, these pyramid-shaped holograms are typically present in small size measurements, requiring the viewer to be at a close distance to observe them.

Figure 5 Pyramid -shaped hologram
Source:(BBC News, 2015)

In contrast to the use of single-sided holograms or on-stage holograms displayed on a single screen, these single-sided display holograms can display images with larger dimensions or actual dimensions (Leister et al., 2008). Consequently, this one-sided hologram is typically utilized for stage performances with a concentrated audience. Even the public can see this one-sided display hologram from a distance or up close. Due to the benefits of this one-sided hologram, it is ideally suited for character display, as it is capable of displaying human-sized characters that appear to be in front of the audience. According to additional research, this one-sided hologram is frequently utilized for human character performances such as concert performances (Yang et al., 2016), speech delivery (Kelion, 2018), and teaching staff representation in the classroom (Luévano et al., 2015), among others. Therefore, the use of one-sided holograms or on-stage holograms is deemed more suitable for displaying hologram tutors in the classroom for the purpose of teaching staff representation.

Past research has demonstrated that lecturers and teachers in the classroom can be replaced by new technological materials such as smartphone displays, computers, and projector screens. As a representative of the teaching force, pedagogical agents are commonly utilized in the classroom and in research (Hamdan & Ali, 2014). Instructors can now be represented in the classroom through a variety of methods and strategies utilizing the most advanced technological tools.

Hologram Tutor

Hologram is one of the technological tools used as a teaching force representation in the classroom today (Kelion, 2018), this is due to the hologram technology's ability to attract students with its features. As with previous research, holograms have been used to display a variety of objects, including products (Shoydin, 2013), human organs (Hackett, 2013), and animations (Guga, 2015). Typically, real human images are used to deliver speeches and lectures when holographic tutors are employed as a teaching force representation (Ghuloum, 2010; Kelion, 2018; Luevano et al., 2019).

Figure 6 Holograms use real human characters.
Source: (Kelion, 2018)

As a temporary teacher in the classroom, the use of holographic tutors as a representation of the teaching force has been the subject of extensive discussion (Ghuloum, 2010). Although the use of this hologram tutor is not expected to completely change the style of education, it is expected to be an effective tool for educators in the future and a necessity in certain circumstances. However, it was once believed that the use of holograms as a representation of the teaching force would be difficult to implement due to high costs, the need for fast internet access, and the difficulty of integrating holograms into the learning environment (Ghuloum, 2010). However, due to the development of technology and the increased speed of internet access, these issues have been effectively resolved. Due to the speed of the internet, the visual transmission of human characteristics can occur simultaneously over great distances (Hamdani, 2019). The use of hologram tutors has increased in the field of distance education as a result of the availability of high-speed Internet access and cutting-edge technological tools (Kalansooriya et al., 2015). Even if students and teachers are in different locations, it is simple to produce and generate tutor holograms as a representation of the classroom's teaching staff.

However, the benefits of using hologram tutors do not depend solely on technological advancements; acceptance and effectiveness of its use must also be considered. Noteworthy is the active participation of students in the use of hologram tutors, for instance (Ghuloum, 2010; Kalansooriya et al., 2015). Even in a study conducted by Kalansooriya et al (2015), the presence of hologram tutors who can interact with students in a realistic manner in the classroom can attract students and make learning sessions more effective, and high cost use is not a major issue. In contrast, significant differences were observed in the experience and engagement of students using the hologram tutor in the classroom (Kalansooriya et al., 2015).

The acceptance of the use of hologram tutors and the engagement of students with hologram tutors is a crucial issue that requires consideration. This is because the acceptance of hologram tutors and student participation will influence student performance (Paredes & Vazquez, 2019). The use of new technologies, such as these holograms, does not necessarily improve student performance; if not handled properly, it may have the opposite effect (Paredes & Vazquez, 2019). Consequently, the social presence of hologram tutors among these students must be considered. Even the presence of a hologram tutor in a face-to-face collaborative discussion can encourage students to participate more systematically in student discussion activities, if the correct hologram tutor is used (Borge et al., 2018).

In conclusion, the use of hologram tutors does provide some benefits in certain circumstances, and the use of hologram tutors as a representative of the teaching staff can aid in attracting students and encouraging them to participate in an activity or receive learning information effectively. However, the presence of technology such as hologram tutors may make students feel uneasy (Kalansooriya et al., 2015). This feeling of unease will hinder student performance (Paredes & Vazquez, 2019) and alter the learning environment in the classroom, thereby diminishing the effectiveness of the use of hologram tutors. Therefore, future research on the use of hologram tutors as a representative of the teaching staff in the classroom should focus on the factors that provide comfort to students when using hologram tutors. Although studies have been conducted on hologram tutors in the present day (Ali & Ramlie, 2021; Ramlie et al., 2020, 2022), additional research can be conducted. Among these are the effects of interaction and use on learning, among others. These studies are important for the future development of hologram tutors and are widely applicable.

Conclusion

In conclusion, numerous technological tools have been utilized and developed in the present to ensure the future viability of learning methods and their capacity to convey information more efficiently. These innovations include online and face-to-face learning techniques. Despite the fact that numerous technological tools have been developed to facilitate the management of learning sessions, a number of factors must be considered to ensure the high level of usability and acceptance by students. Therefore, each upgrading or innovation process for learning methods must be conducted with care and under the direction of the appropriate development process. This is to ensure that technological tools and materials can be used for an extended period of time, as well as to preserve the sustainability of learning methods.

Research Contribution

It is essential that research on technology tools and educational innovation is undertaken meticulously on the basis of a number of specific aspects, as discussed based on reference sources and previous studies. This is due to the fact that any technology innovation in the field of education must consider elements that are likely to impede the usability of the technology tool and have a negative influence on pupils. Consequently, research undertaken on the use of technology tools as learning aids, such as hologram tutors, can contribute to the creation of a technology tool by providing guidance. Because of this, every creation of technological tools in the field of education must adhere to the proper criteria for its use to be effective and have a beneficial impact on student learning. Furthermore, every educational institution can benefit from every technology innovation. In addition, in order to design new technology tools for instructional strategies, researchers must consider each foundation that has contributed to each education revolution from Education 1.0 to Education 4.0. This study aids in the formulation of the aspects that must be stressed in the innovation and technical tool development processes.

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