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VIRTUAL REALITY TECHNOLOGY AND ITS ROLE IN DEVELOPING THE SPECIALIZED SKILLS OF GRAPHIC DESIGN STUDENTS

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ABSTRACT

One of the most significant technological developments impacting the field of graphic design is virtual reality technology. This technology offers unique opportunities to enhance the teaching and learning, simulate creative thinking, and increase student motivation factors that are essential for cultivating specialized skills among graphic design students. At Sultan Qaboos University, Virtual reality technology was introduced into the graphic design curriculum in the Department of Art Education during fall semester of 2019, marking a transformative step in the educational process. Its integration raised important questions Can VR foster the development of specialized skills among graphic design students, and what specific skills are most affected? To addresses these questions, the researchers conduct a study during spring semester of 2024 in the Graphic Design (2) course. The instructional process incorporated digital art and design software operated through VR glasses, providing students with an immersive learning environment. Continuous observation was used to track student's progress while individual interviews captured their experiences ad perceptions. The results reveals that Virtual reality technology has a significant and influential positive impact on the development of several specialized skills, enabling to create high-quality digital artworks within an engaging virtual environment. The study highlights the importance of integrating VR into the graphic design curriculum, to equip future art educators with contemporary technical skills. Such integration not only enhance their own professional competencies but also empowers them to transfer these skills to future students in general education, thereby sustaining a continuous cycle of innovation and skill development.

KEYWORDS: Virtual Reality, Teaching Graphic Design, Graphic Design Students, Specialized Skills, Skill Development.

1. INTRODUCTION

1.1. Virtual Reality Technology

The academic preparation of these students is different from what it was just a few years ago. University education is an essential and crucial stage in shaping a university student's personality, providing them with knowledge, experience, and various skills (Puerta Gómez et al., 2024). It also helps prepare them to meet societal demands and fulfill their duties to the fullest. The university student, their professional qualification, and their appropriate evaluation have become important and urgent issues, given the abundance of technological data generated by the Fourth Industrial Revolution, such as 3D printing, virtual museums, artificial intelligence, and others (Sahai & Rath, 2021).

Virtual reality (VR) technology enables the creation of three-dimensional virtual environments that users can interact with (Geng & Wu, 2021). This technology is used in multiple fields, including gaming, education, and entertainment. As Gilbert, (2023) notes, "Virtual reality offers new and innovative opportunities for student learning by creating more realistic and interactive learning experiences, enhancing learning and understanding." VR can also be used to design personalized experiences for users. For example, a virtual environment similar to a flight test chamber can be created, allowing users to experience the sensation of flying without leaving their homes. Additionally, VR is used to design fun and engaging educational experiences, such as virtual tours of museums or historical sites, or to simulate surgical procedures. According to (Gilbert, 2023), VR can be used in a variety of fields, including education, healthcare, training, marketing, and entertainment.

In education, virtual reality is used to provide more realistic and interactive learning experiences for students, enhancing learning and understanding (Marougkas et al., 2023). For example, virtual reality can be used to organize virtual tours of historical or natural sites, or to train students in specific skills such as driving or performing surgery. Although VR technology is relatively new, it is rapidly evolving, enabling the creation of more realistic and interactive experiences (Yuhan et al., 2024). As this technology continues to evolve, it is expected to become more widespread and widely used in various fields.

Figure 1. A Scene Generated By Generative Artificial Intelligence, Of A Male And Female Student From Oman, Wearing Virtual Reality Glasses And Practicing Digital Art Via Tablets.

The following are examples of the uses of virtual reality in various fields.

- Virtual reality can be used to help patients overcome their fear of heights, flying, or public speaking. It can also be used to relieve pain and improve sleep quality.
- In the field of training, Virtual reality enables employees to be trained in specific skills such as driving cars, performing surgeries, or dealing with emergency situations.
- In marketing, Virtual reality can be used to provide more engaging promotional experiences for customers. For example, it can be used to showcase new products or services or to take customers on virtual tours of retail locations.
- In the field of entertainment, Virtual reality provides the possibility of developing new and more exciting games, movies, and experiences, such as flight simulation, car driving, or combat games.

1.2. Virtual Reality Technology in Digital Arts and Graphic Design

In addition to the above, the benefits of using virtual reality technology include providing an enjoyable and engaging learning experience, promoting active and engaging learning, enhancing creative skills, providing a safe environment for experimentation, reducing stress and anxiety (Lin & Wang, 2021), and increasing motivation for learning. For example, digital arts have become a field of widespread interest among art and design students in educational institutions around the world, particularly in the Arab world. Among these

institutions (Mohamed Ali Nawar El Misry, 2021), Sultan Qaboos University stands out as one of the universities paying great attention to this field. This interest is due to the continuous technological development witnessed by digital arts, in addition to the unlimited creative possibilities it offers students (Bramantyo, 2021). Digital arts are not only a means of artistic expression; they also represent a bridge between art and technology, opening new horizons for students to explore their creative potential.

The use of virtual reality (VR) technology falls within this evolutionary context and is among the modern methods that can significantly contribute to developing the specialized skills of students studying graphic design courses within the undergraduate program (specializing in art education) (Marougkas et al., 2023). These courses are: Graphic Design (2) and the Art Project. At the graduate level: Contemporary Technological Media in Art and Their Applications. This innovative technology allows the creation of three-dimensional virtual environments that students can interact with via a digital interface similar to conventional operating systems such as Microsoft Windows or iOS, adding a new dimension to the learning experience (Yeo et al., 2024). Virtual reality provides students with a realistic simulation of the concepts and ideas they are studying, deepening their interaction and understanding of various subjects, especially in the field of graphic design (Al-Ansi et al., 2023). Through this technology, students can engage in unconventional educational experiences that go beyond the boundaries of traditional classrooms, allowing them to explore and devise new creative solutions.

Figure 2. A Scene Generated By Generative Artificial Intelligence, Of A Male And Female Student From Oman, Wearing Virtual Reality Glasses And Practicing Digital Art.

Virtual reality technology not only enhances theoretical learning but also provides a platform for practical learning where students can experiment with ideas and designs in a safe and risk-free environment (Al-Ansi et al., 2023; Yang & Fan, 2025). This opportunity provides them with the opportunity to continuously improve their technical and creative skills through direct interaction with 3D objects and apply what they have learned in virtually real-life scenarios. This type of interaction enhances their critical thinking and problem-solving abilities, making them better prepared to face the challenges they may face in their future careers in digital art and design (Chen et al., 2024).

Therefore, integrating virtual reality technology into art and design curricula is a step toward a more interactive and innovative educational future, where students can not only learn new techniques but also develop creative ways of thinking, which will positively impact their professional future.

Figure 3. Shows Part Of What A Person Wearing Virtual Reality Glasses Sees, Including A Virtual Brush And Colors, Lighting, And A Drawing Board.

1.3. Research Problem

One of the most prominent technological developments that has significantly impacted the field of graphic design is the adoption of virtual reality technology. This technology holds great promise for improving the teaching and learning experience, as it contributes to enhancing thinking skills and stimulating student motivation, which helps develop their specialized skills, especially for art education students studying graphic design courses at Sultan Qaboos University (Chen et al., 2024; Kalyani, 2024). With the significant expansion of technological tools resulting from the Fourth

Industrial Revolution, such as 3D printing, virtual museums, and artificial intelligence, the educational process for these students has become markedly different from what it was previously (Sahai & Rath, 2021). Virtual reality technology has been included in the graphic design course since the fall 2019 semester, sparking student enthusiasm and raising many questions about the extent to which these technologies can enhance specialized skills in graphic design. Based on these data, this study aims to explore the actual roles that virtual reality technology can play in developing specialized skills among students and to evaluate the possibility of its effective integration into the curriculum.

1.4. Research Questions:

RQ1: What are the positive effects of virtual reality technology in developing some specialized skills among students studying the Graphic Design (2) course at Sultan Qaboos University?

RQ2: How can virtual reality technology help art education students produce digital works with high aesthetic values in an interactive virtual environment?

RQ3: What is the impact of teaching virtual reality technology in graphic design courses on transferring contemporary technological skills to general education students through qualified teachers?

1.5. Research Objectives

1. Exploring the positive effects of virtual reality technology in developing some specialized skills among students of the Graphic Design (2) course at Sultan Qaboos University.
2. Analyze how virtual reality technology can be used to help art education students produce digital works with high aesthetic values in an interactive virtual environment.
3. Study the impact of teaching virtual reality technology in graphic design courses on transferring advanced technological skills to general education students through qualified teachers.

2. LITERATURE REVIEW

Lou, (2017) discussed virtual reality technology in a study titled "Graphic Design Teaching System Using Virtual Reality," published in the International Journal of Emerging Technologies in Learning. The study called for the development and implementation of a virtual reality-based educational system for teaching graphic design. The study also reviewed how virtual reality technology can enhance the teaching and learning experience by providing immersive environments lacking in traditional methods. The author highlighted key features of the system, such as interactive tools and real-time 3D modeling, which give students hands-on experience in a virtual workspace. This system is designed to improve student engagement, creativity, and understanding of complex design concepts, particularly in areas such as spatial awareness and composition. The research also addressed challenges, such as the technical skills required to use virtual reality software and the costs associated with integrating these systems into educational curricula. Overall, the study concluded that virtual reality is a promising tool in graphic design education, but its success depends on proper implementation, including providing adequate training and resources for students and teachers.

Zhou (2024) which addressed the rapid development of computer technology that led to new innovations and inventions in fields including virtual reality technology, such as graphic design for digital oil painting scenes. The study aimed to explore graphic design for digital oil painting scenes based on virtual reality technology, and to verify its feasibility and impact through experiments. Experimental methods were used by creating a graphic design model for a digital oil painting scene based on virtual reality technology. The results showed that the graphic design model for a digital oil painting scene based on virtual reality technology provides a more realistic and interactive design experience. The results of user surveys and evaluations also showed that users who used the design model achieved significant improvements in design effectiveness, user experience, and creativity

Al-Ali, Dr. I. B. Kh., (2024) is a recently published study. The study aimed to identify the extent to which virtual reality technologies are employed in educational activities for university students with the aim of improving advanced cognitive skills (analysis, evaluation, creativity - according to the updated Bloom's taxonomy), as well as revealing the extent of university students' knowledge of virtual reality technologies and their various uses in the educational process. The results of this study showed that there is a positive and significant relationship between students' level of knowledge of virtual reality technologies and their skills of analysis, evaluation, and innovation. Therefore, the level of university students' knowledge of virtual reality technologies contributes positively to improving their advanced cognitive skills. The study recommended the need to provide training programs

for faculty members that focus on enhancing their skills in using virtual reality technologies in the educational process, as well as their use of virtual reality technologies in a variety of educational fields and curricula, in order to improve the learning experience for students and enhance advanced cognitive skills in various educational situations. The study also recommended the need to review and update university course descriptions to include advanced activities that require advanced cognitive skills, such as the use of modern technologies, such as virtual reality technologies, and to motivate students to use these technologies in various educational situations.

The three studies addressed the topic of employing virtual reality technologies in education in diverse ways, each making significant contributions. The first study, by Lou, (2017), focused on developing a graphic design teaching system using virtual reality, demonstrating how this technology can enhance the learning experience through three-dimensional interactive environments, thus contributing to improved student engagement and creativity. Despite challenges related to cost and technical skills, the study concluded that virtual reality is a promising tool for teaching graphic design. Meanwhile, Zhou, (2024) reviewed the positive impact of virtual reality technology on the design of digital oil painting scenes. The results showed that the use of this technology enhanced the interactive and realistic experience for users, contributing to the development of their creative skills and design effectiveness. Al-Ali, Dr. I. B. Kh., (2024) addressed the role of virtual reality technologies in improving advanced cognitive skills among university students, such as analysis, evaluation, and creativity, confirming a positive relationship between students' knowledge of these technologies and improved academic performance. The study recommended the need to provide training programs for faculty members to employ virtual reality in the educational process and update curricula to keep pace with these technological developments. Despite the importance of the findings of these studies, this study sought to clarify the role virtual reality technology plays in developing specialized skills among graphic design students, especially among students in the Department of Art Education studying graphic design courses at Sultan Qaboos University.

3. RESEARCH METHODOLOGY

To achieve the research objectives and answer the questions posed, the researchers adopted a comprehensive, multi-tool approach, which was implemented in an experimental environment within the "Graphic Design (2)" course during the spring semester of 2024 at Sultan Qaboos University. The focus was on using virtual reality technology to teach digital art and design software. Students were provided with virtual reality glasses connected to the internet, allowing them to work in an interactive virtual environment that simulates real-life graphic design scenes.

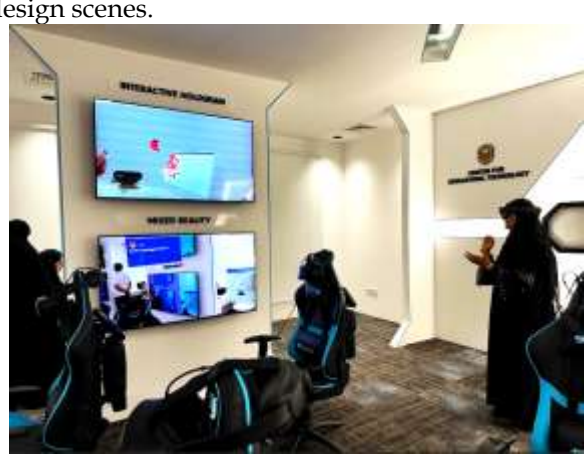

Figure 4: Shows The Students' Interaction With Virtual Reality Technology When Performing Some Exercises In Digital Art.

The methodology focused on using continuous observation to measure the development of the participating students' specialized skills, in addition to conducting individual interviews with some students to explore their personal opinions and experiences with the new technology. These methods enable researchers to obtain both qualitative and quantitative data. Continuous observations provide a clear picture of the gradual development of students' technical and technological skills, while interviews enable an understanding of the personal dimensions and individual experiences related to the use of virtual reality in learning.

The methodology also focused on evaluating student artwork resulting from the use of virtual reality technology, measuring the quality of artwork in terms of aesthetic and creative values. The results showed that students who used virtual reality in design were able to produce high-quality digital artwork and enhance their specialized skills in multiple areas, such as interacting with the virtual environment and spatial awareness.

This methodology provides flexibility for broad application of the technology within the curriculum, while emphasizing the importance of providing adequate training for students and teachers to use the technology effectively. Based on the results, the research concluded that virtual reality technology

directly contributes to improving specialized skills, enhancing student interaction and creativity, and contributing to the transfer of these skills to general education levels, creating a cycle of sustainable development between teachers and students at various levels of education.

3.1. Research Limits

It is represented by the following determinants:

1. Subject Matter: The study focusses on integration of Virtual Reality Glasses, Tablets, and Smartphones as primary technological tools in the educational process.
2. Timeframe: The research was conducted during the Spring 2024, ensuring that data collection reflects the academic activities and condition specific to this period.
3. Spatial boundaries: the study carried out within the Graphic Design Lab, Department of Art Education at the College of Education, Sultan Qaboos University, providing a controlled and discipline- specific learning environment for the research.

3.2. Research Sample

The research sample consisted of a group of students enrolled in the course "Graphic Design (2) course". These participants were selected as they represent the target population most directly involved in applying augmented reality technologies within the context of graphic design education.

3.3. Research Hypotheses

Researchers hypothesize that virtual reality technology can have multiple roles in the following:

H1: Developing some specialized skills among students studying the Graphic Design (2) course at Sultan Qaboos University

H2: Supporting art education students in producing digital works with high aesthetic values in an interactive virtual environment.

H3: Teaching virtual reality technology through graphic design courses plays a role in transferring contemporary technological skills to general education students through qualified teachers.

3.4. Operational Definitions

3.4.1. Virtual Reality Technology

Virtual reality technology is a technology that allows the user to experience a real-life situation in a virtual environment. This is achieved through the use of special devices that create a three-dimensional environment surrounding the user from all sides. This technology allows the user to interact with the virtual environment in an interactive manner, contributing to an enjoyable and engaging learning experience. In short, it is a technology that creates a three-dimensional virtual environment with which users can interact. Saudi researcher Mohammed Al-Arfaj defined it as "a technology that allows the user to simulate the experience of being in a virtual environment, through the use of special devices that create a three-dimensional environment surrounding the user from all sides." (Al- Arfaj, 2016).

3.4.2. Specialized Skills

Specialized skills refer to the set of artistic and technical skills a student needs to produce high-quality artwork. These skills include the ability to interact with advanced digital tools such as 3D design software, digital printing, and virtual environments. Virtual reality technology contributes to the development of these skills by providing an interactive learning environment that simulates reality and allows students to practice design concepts such as spatial composition and interacting with visual elements in real time. Additionally, specialized skills include the ability to use innovative technologies such as virtual reality glasses to analyze creative ideas, work with modern software, and transform artistic concepts into effective digital models. Thanks to these technologies, students can acquire advanced skills that help them produce aesthetically pleasing digital works that align with contemporary professional requirements in the field of graphic design. These skills also enable them to transfer these skills to other educational levels, such as teaching them to general education students.

3.4.3. Digital Art

Digital art is any artwork produced using a computer or digital technologies. Egyptian researcher Abdullah Ghoneim defined it as "any artwork produced using a computer or digital technologies, including drawings, photographs, films, music, and performances." Ghoneim (2005).

3.4.4. Technology And Art

Technology and art are two sides of the same coin. Technology can be used to create new and wonderful works of art, and it can also be used to display and share art with others. Egyptian researcher Abdullah Ghoneim defined the relationship between technology and art as "a complementary relationship, where technology is used to create new and wonderful works of art, and it can also be used to display and share art with others."

Technological awareness is a necessity imposed by the current circumstances for many reasons, the most important of which are the nature of the new world order, the acceleration of science and technology(Haas et al., 2023), the social nature of science and technology, and the exacerbation of some problems of science and technology. Therefore, this technology must be understood, and its positives and negatives must be understood, and plans must be prepared that target people's awareness of the variables it raises, the skills to deal with it, and new technologies and cultural factors that are expected to occur in the future (Steers et al., 2008). Any understanding of technology must include a series of issues underlying the world of university, home, and society.

Technological awareness in education is considered an important element in the educational field and one of the basic tasks of the teacher in light of the reality of rapid technological and informational change, which emphasizes the need to increase attention to the knowledge and skills associated with technological awareness through educational strategies. (Mohamed Salah Sharaf)

3.4.5. Teaching Graphic Design

"Graphic design teaching," as defined by the Egyptian researcher Khalifa, (2005) in his research paper, "Teaching Graphic Design: A Pedagogical Perspective," "is an educational process that aims to develop students' skills in the field of graphic design, including creative thinking skills, visual communication skills, and digital technology skills." (Khalifa, 2005). Graphic design teaching incorporates a variety of tools and methods, including discussions, presentations, and practical projects. Graphic design teaching aims to prepare students to enter the graphic design job market or to pursue graduate studies in this field.

4. THEORETICAL FRAMEWORK

The theoretical framework of this research consists of three main axes:

1. First, the highly important augmented reality technology, where the basic dimensions of this technology will be reviewed, including its definition, history, advantages, disadvantages, and some related aspects.
2. Second, active learning in the field of graphic design (2) study units, and how to use augmented reality technology to motivate students and increase their motivation to learn. Third, the relationship between the field of graphic design and augmented reality technology will be discussed, highlighting the advantages and disadvantages of this relationship.

4.1. The First Axis: Augmented Reality Technology: History And Development

Augmented reality (AR) is one of the most prominent modern technologies, generating interest and significantly impacting many fields, from education to the entertainment and medical industries (Villagran-Vizcarra et al., 2023). This technology simulates the user's surrounding environment by combining virtual elements with the real world, providing an enhanced, interactive, and realistic experience. In this research, the researchers review the history of the emergence of AR technology and its development over the years, as follows:

The roots of augmented reality technology go back decades, with initial research and experiments focusing on developing ways to integrate digital elements with the real world (Dargan et al., 2023). However, the technology has seen significant progress in recent years thanks to technological developments and the expansion of its areas of application. The story began in the 1970s, when researchers began to consider how to extend the scope of reality using computer technology (Staley, 2015). In 1968, scientist Ivan Sutherland invented a system known as " The Sword of Damocles Visionary System," the first system that allowed the user to see a virtual world blending with the real world (Azuma, 1997), as shown in Figure 5.

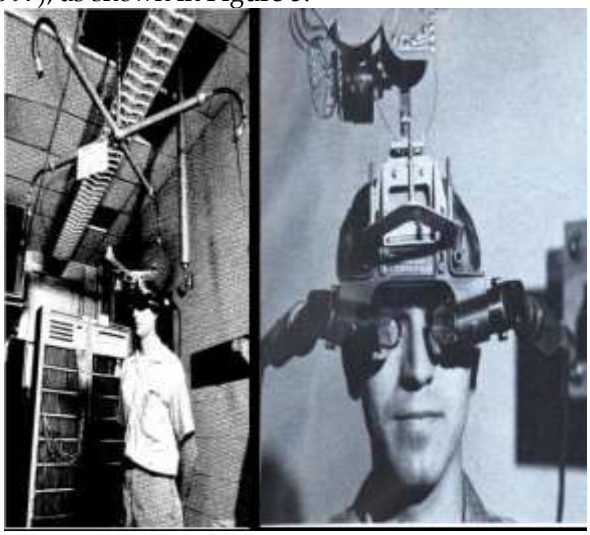

Figure 5. The Scientist Ivan Sutherland and His Invention of a System Known as "The Sword Of Damocles" In the Year of 1968.

With the advancement of computer and graphics technology, augmented reality technology began to

develop rapidly. In 1990, the term "augmented reality " was coined by researcher Tom Caudell of Boeing. During the same period, during the 1990s, initial applications of this technology appeared in the fields of gaming and environmental interaction (Azuma, 1997). With the rapid expansion of the use of smartphones and tablets, augmented reality experiences became possible via mobile devices.

Today, we are witnessing tremendous progress in technology, allowing augmented reality technology to expand further into our daily lives. This technology can now be used through smart glasses and custom glasses, as well as smartphone applications that enable users to enjoy the augmented reality experience more easily and widely than ever before.

4.1.1. The Importance of Augmented Reality Technology in Education: Between Motivation and Challenges

1. Technology is witnessing amazing developments in various aspects of life, including the educational field. Augmented reality technology is one of the most prominent modern technologies that combines the virtual and real worlds with the aim of improving the learning and teaching processes. This technology is distinguished by its ability to enrich the student experience by providing interactive and realistic educational content, which enhances critical thinking and encourages the development of creative skills (Klopfer et al., 2002). In addition, augmented reality technology offers many other advantages, including:
2. Providing realistic and interactive experiences: Augmented reality technology enables educational content to be presented in a tangible, realistic manner, allowing students to interact with 3D models and complex shapes using technological devices. This interaction helps facilitate understanding of difficult concepts and enhances students' ability to absorb information more effectively.
3. Stimulating exploration and discovery: Augmented reality technology contributes to enhancing students' motivation to explore information in innovative and engaging ways. They can interact with educational materials directly, helping them understand concepts more deeply through hands-on experience and active participation.
4. Enhancing Collaborative Learning: Augmented reality technology enables enhanced interaction and collaboration among students, enabling them to work together to solve problems and explore educational content together. This group interaction contributes to the development of group thinking skills and encourages collaborative work among students, enhancing the effectiveness of collaborative learning (Akhtar et al., 2022)

4.1.2. Potential Downsides of Augmented Reality Technology in Education

There are some expected drawbacks when applying augmented reality technology in education, the most prominent of which are:

1. Cost of infrastructure and devices: Augmented reality technology may be expensive for schools and educational institutions, as it requires advanced infrastructure and specialized devices such as smart glasses and other tools to support this technology.
2. Training and usage challenges: Training teachers to use augmented reality technology can be challenging, as teachers may need to acquire new skills to deliver educational content effectively and attractively using this technology (Dunleavy, 2014).
3. Health and social impacts: Some health and social impacts may result from excessive use of technology, such as increased screen time and decreased real-life social interaction, which may affect students' well-being and direct social interaction.

Figure 6: A Model Showing How To Wear Augmented Reality Glasses, And What The Student Sees In Front Of Him.

4.1.3. Devices That Can Support Augmented Reality

A variety of devices are available that support augmented reality technology, including:

1. Smartphones: Smartphones are among the most widely used devices for augmented reality applications. The technology is enabled by the smartphone's camera and special sensors, allowing 3D images and graphics to be displayed on the screen.
2. Augmented reality glasses: Augmented reality glasses feature a small display that is held in front of the user's eyes. These glasses provide a more immersive experience compared to smartphones, as the user can interact with virtual objects directly without having to look at the screen, as shown in Figures 8, 7, and 6.
3. Tablets: Tablets can also be used to display 3D images and graphics, but their use in augmented reality applications is not as common as smartphones or augmented reality glasses.
4. Portable Augmented Reality Devices: Devices such as HoloLens and Magic Leap are among the most advanced devices that support augmented reality. These devices offer a highly immersive experience, allowing the user to interact with virtual objects within the real environment, further enhancing the interactive experience compared to other devices.

Figure 7: A Model Showing Wearing Hololens Glasses That Support Augmented Reality, And What the Student Sees in Front of Him.

Figure 8: Magic Leap Glasses That Support Augmented Reality, One Of The Best Glasses That Support Education Via Augmented Reality.

Each of these devices has different capabilities and features. For example, smartphones and handheld AR devices provide access to a wide range of AR-based applications and games, while AR glasses allow for a more immersive experience and freedom to interact with virtual objects without having to look at the screen (Dargan et al., 2023; Dunleavy, 2014).

Choosing the most appropriate device depends on the user's needs and available budget. After comparing these devices and their features, the researchers decided that the smartphone was the best option for conducting this research study, due to its diverse capabilities and widespread availability. Therefore, it was chosen as the primary tool for this experiment.

4.2. Axis II: Active Learning towards the Study Units Related To Graphic Design

Graphic design is a field that combines creativity and the art of visual communication, aiming to convey ideas and messages in an engaging and effective manner. In light of the continuous developments in education and technology, educators are seeking to adopt teaching methods that promote effective interaction and help develop students' critical thinking skills. Among these methods, "active learning" stands out as an effective approach to teaching graphic design, allowing students to actively participate in constructing knowledge and developing their skills through applied and practical methods (Jonassen, 2008).

Active learning is a teaching approach that allows students to be an integral part of the knowledge-building process, encouraging them to engage in activities such as group discussions, problem-solving, and learning through hands-on experiences, such as exploring augmented reality applications. In this learning environment, learning is combined with fun and discovery, unlike traditional learning approaches that focus primarily on the teacher as the primary source of knowledge. Active learning, on the other hand, encourages students to be researchers and participants in the creation of knowledge (Bonwell & Eison, 1991)

4.2.1. Applying Active Learning in Teaching Graphic Design

By reviewing previous studies, such as Bonwell & Eison (1991) and Jonassen (2008), the researchers found that there are several teaching methods that can contribute to activating active learning in the teaching of graphic design. Among these methods are:

1. Interactive projects: Interactive graphic design projects can be implemented that involve a group of students actively working with tablets and augmented reality applications. Through these projects, students learn how to apply design concepts in real-world contexts within a stimulating digital environment, such as an augmented reality environment (Bonwell & Eison, 1991).
2. Discussions and brainstorming: It's helpful to encourage students to participate in group discussions about their ideas and designs. This helps develop their critical thinking and analytical skills, and enhances their ability to express their ideas and provide logical explanations.
3. Problem-solving: Design problems can be presented that require students to research, analyze, and devise effective solutions. This type of activity fosters creative thinking and encourages students to engage in creative thinking.

On its application in realistic and tangible design tasks (Jonassen, 2008).

As a practical example, an application such as Quiver Vision has a significant role in promoting this type of thinking, as it is considered one of the augmented reality applications that encourages creative interaction and critical thinking in the context of learning graphic design.

Despite the numerous benefits of active learning in teaching graphic design, it can face some challenges that require careful planning by the instructor. For example, active learning requires designing interactive projects and activities that require careful planning, with clear assignments tailored to the student's level. There is also a need for ongoing supervision and guidance for students, especially those who require technical or instructional support during project implementation and problem-solving. It is important to strike a balance between autonomy and supervision to ensure that students receive the necessary guidance while maintaining sufficient space for exploration and innovation.

From the above, it is clear that using an active learning approach in teaching graphic design can contribute to deeper and more effective learning, especially when contemporary technologies such as augmented learning using augmented reality are incorporated. This approach encourages students to actively and interactively participate, which contributes to the development of their creative skills in the field of graphic design (Bonwell & Eison, 1991).

The Third Axis: The Relationship Between the Field of Graphic Design and Augmented Reality Technology

The above demonstrates that the role of the graphic design professor is crucial in encouraging students to acquire technical knowledge and practice graphic design, particularly using augmented reality technologies and related applications. It is essential for the professor to familiarize students with a variety of digital applications that support augmented reality, such as Artiviva, SketchAR, and QuiverVision(T.-Y. Tai, 2025) (N.-C. Tai, 2023), so that students can choose the technology that best suits them and helps them achieve active and effective learning.

Furthermore, teachers should encourage students to be innovative and creative in their work, which can be achieved by allowing them to challenge the rules after understanding and absorbing them. Providing support and guidance is also essential, especially since some digital applications can be challenging for students who do not have sufficient experience with them. Additionally, teachers should motivate students to participate in digital art exhibitions and reward them for outstanding achievements. Showcasing the artwork of others is an important part of the educational process, as it helps students receive valuable feedback, which enhances their artistic skills and motivates them to continue learning and growing Figure 9.

Figure 9: Illustrates The Mechanism Of Using The Tablet In Developing Digital Design Work.

Graphic design is a creative process that combines art and technology and is the most effective tool for communicating ideas through electronic media. Graphic design includes two main aspects: the first is the design process itself, which relies on the designer's skills and creativity, and the second is the results of this process, which includes a wide range of designs such as logos, trademarks, advertising posters, and content published in magazines, newspapers, and websites. Graphic design relies on combining writing with various design elements such as shapes, colors, and graphics to create a visual product intended to convey specific messages in an attractive and effective manner. As stated in the Graphic Designer's Handbook issued by the Association of Graphic Designers (AIGA, 2003), " Graphic design is a creative process that combines art and technology to create visual communications that convey information, influence emotions, and stimulate action " (AIGA, 2003).

The above demonstrates that the field of graphic design is one of the most capable fields of capitalizing on technological developments, by employing creative problem-solving strategies that include:

- Enhancing the use of advanced technology.
- Transforming ideas into actionable solutions.
- Linking design efforts to business strategy objectives.
- Integrating design as an essential part of building a visual identity.

Based on this, the researcher concluded that graphic design is the most suitable field within art education to employ modern technologies such as augmented reality. Through this technology, students can acquire new skills and advanced technical knowledge by practicing digital art using applications such as Artiviva, SketchAR, and QuiverVision. These tools not only contribute to achieving educational and pedagogical goals but also support students within the system of educational aids, helping them produce outstanding digital artwork. These students can publish their works through various virtual exhibitions, contributing to the development of their creative skills and enhancing their continuous artistic growth.

Figure 10: Quivervision Is A Program Designed In An Augmented Reality Environment, Where Hand-Colored Images Are Converted Into Illusory Objects That Interact With The Student Via Smart Screens.

Figure 11: The Hand-Drawn Drawing Executed by the Student with Colored Pencils or Any Colors That the Application Recognizes. Quiver Vision: Through A Barcode, It Turns Into An Illusory Model That Can Be Viewed On Smart Screens.

To support the above-mentioned ideas, this research relied on a group of previous studies, including:

A study, "The Effectiveness of a Training Program Based on Augmented Reality Technology in

Developing Artistic Design Skills and the Ability to Imagine Among Female Students in the Department of Art Education at Al-Aqsa University (Al-Hammarneh, 2022). "

This study aimed to measure the effectiveness of an augmented reality-based training program in developing artistic design skills and imagination among female students in the Art Education Department at Al-Aqsa University. The researcher used a quasi-experimental approach based on a single-group design with pre- and post-tests. The general model of instructional design was applied in developing the training program. The study sample included 27 female students enrolled in the Computer Graphics course in the Art Education Department.

The study tools consisted of an observation card to measure artistic design skills, a product evaluation card to measure artistic design production skills, and a scale for imagination. The study was conducted at Al-Aqsa University in Gaza in 2021 (Al-Hammarneh, 2022). The study made several important recommendations, most notably the need to include technological innovations such as augmented reality technology in the teaching of artistic design skills, and to focus on developing the ability to imagine (imaginative thinking) in university education in general, and in the teaching of fine arts in particular. It also recommended the need to provide laboratories equipped with modern educational technologies, especially augmented reality technology, in fine arts colleges. The study emphasized the need for artists to develop their knowledge of modern technologies such as augmented reality due to their positive impact on developing their professional skills (Al-Hammarneh, 2022).

Another Study by Asr et al., 2022, "Augmented Reality Applications as a Technological Medium to Enrich Contemporary Art"

This study examined the relationship between visual art and technological development, particularly with the emergence of media arts. The tools of expression in visual art have undergone significant changes. Artists are now able to express their ideas using modern and advanced technological tools. The study also discussed the modern digital techniques used in the composition of artwork and identified the diversity of media art types. Artwork is no longer limited to static paintings hung in a frame, but rather takes on multiple forms and incorporates the element of movement, whether illusory or actual. This concept has expanded to include interactive artworks within augmented environments or in the physical world.

The study confirmed that the relationship between art and technology has grown stronger and deeper, with the internet becoming an essential part of modern art projects. In addition, other technologies such as video art, computer games, smartphones, and handheld computers have contributed to providing amazing informational visual experiences. The study also viewed these technologies as creative exploration tools for new opportunities in art history, and emphasized the importance of reviewing the various art schools that have adopted augmented reality technology and integrated it into contemporary art styles.

The study recommended a number of recommendations, the most important of which are:

1. It is necessary to have comprehensive and detailed knowledge about augmented reality tools and techniques in order to enable the artist to successfully translate his creativity using these modern tools.
2. The need to conduct further studies on the use of augmented reality technology in the visual arts and link it to art education, with the aim of enhancing artistic creativity and developing educational curricula in this field (Asr et al., 2022).

A study by Abdul Jalil, (2020), "The effect of the interaction between an active learning strategy in an augmented reality-based environment and the learning method on developing the skills of producing electronic courses among educational technology students."

This study aimed to measure the interaction effect between a proposed strategy based on active learning in an augmented reality environment and the learning style on developing the skills of producing e-courses among educational technology students. Accordingly, a proposed vision for an augmented reality strategy was presented, aiming to develop e-course production skills. The strategy consists of five stages: the introductory stage, the preparation stage, the planning and design stage, the implementation stage, and finally the evaluation stage. Design criteria were determined according to augmented reality environments and based on the learning style (independence and dependence) in the cognitive domain. An integrated learning environment was also designed to include skills specific to producing e-courses using the Storyline Articulate program with a grading system, through the application of Blippar as an augmented reality tool.

The results showed a positive impact of the interaction between the proposed strategy in an

augmented reality environment and the learning style on developing the skills of producing e-courses among educational technology students. The study recommended a set of important recommendations, most notably leveraging the proposed strategy in an augmented reality environment to enhance students' skills, as well as utilizing the list of e-course production skills identified in the study, in addition to leveraging the strategy's criteria in an augmented reality environment to enhance the educational process.

5. SUMMARY OF RESULTS

Some previous studies have focused on the potential of augmented reality technology, particularly in the fields of art and design, such as the master's thesis (Al-Hamarneh, 2022). Some studies have also focused on the applications of augmented reality as a technological medium for enriching contemporary art, such as the study (Asr et al., 2022). Additionally, some previous studies have examined the impact of the interaction between active learning strategies in an augmented reality-based environment and learning style on developing e-course production skills, such as the study (Abdul Jalil, 2020).

The benefit of reviewing previous studies was represented in clarifying the research problem and its importance, and choosing the appropriate tools and methodology for this study. The current study distinguished itself from previous studies in that it addressed the role of augmented reality technology in developing active learning skills among students in the Graphic Design (2) course at Sultan Qaboos University, which adds a new dimension to the applications of augmented reality in the field of technical education.

5.1. Results

At the end of this research, study yielded a comprehensive set of significant findings, which are outlined as follows:

- Employing augmented reality (AR) technology in the educational process, particularly in graphic design courses, provided highly effective in enhancing students' active learning skills. It also boosted students' motivation and encouraged deeper engagement with various instructional modules. By integrating AR with educational content, students were able to interact with design concepts and tools in more innovative, practical and immersive ways, thereby strengthening their conceptual understanding and motivating promoting self-directed learning.
- The integrating of modern technologies, such as augmented reality (AR), with both cognitive and skill-based content in graphic design courses significantly improved students' academic achievement. This integration enabled students to grasp complex design concepts more easily and apply them interactively, which in turn led to higher-quality learning outcomes. Moreover, augmented reality created a rich, immersive, and dynamic learning environment that stimulated curiosity and encouraged students to explore the course content in a more profound and interactive manner, thereby support the holistic development of their academic, technical skills, and creative abilities.
- Engaging with augmented reality devices, including smart screens, and specialized applications, as a pivotal factors in developing students advanced digital competencies. These competencies equip learners to face future technological challenges confidently and foster openness to innovation and emerging digital tools. Overall, the study confirmed a substantial positive impact of augmented reality on enhancing active learning skills among students in the Graphic Design (2) course at Sultan Qaboos University. The finding showed that students who used augmented reality demonstrated this technology showed greater enthusiasm, higher engagement levels, and more innovative approaches to producing artwork compared to their peers relying on conventional methods.
- Furthermore, student who accessed augmented reality applications via smart screens exhibited superior abilities in collaborative and creative interaction. This collaboration enabled them to explore diverse AR applications, which led to the production of unique and innovative digital artwork in the field of art and design. Their capacity to engage with artistic content in novel ways further deepened their understanding of core design principle and enhanced their creative problem-solving skills..
- Comparative analysis between students exposed to augmented reality based instruction and those who followed traditional teaching methods showed augmented reality supported were more enjoyable, less stressful and more engaging. When augmented reality

seamlessly integrated into the learning environment, students experience higher level of interest, enthusiasm, and motivation to engage the course material, making the overall learning experience both stimulating and immersive.

- The rationale for adopting augmented reality technology in education stems from its unique capability to blend virtual information and computer-generated imagery. with the real-world environment. The fusion offer students an innovative mode of interacting with educational content, allowing them to visualize and manipulated complex concepts in an intuitive, interactive, and visually engaging manner. .Augmented reality enhances students' ability to understand complex concepts by visually and interactively presenting them.
- AR has demonstrated its effectiveness across a range of disciplines—including education, healthcare, tourism, entertainment, industry, gaming, design, and advertising. In educational contexts, particularly in graphic design instruction, AR enriches the learning experience by enabling students to explore, experiment with, and engage interactively with course materials in creative, practical, and immersive ways.

5.2. Recommendations

Based on the research findings, the researchers presented a set of recommendations that they believe will be of great benefit in integrating augmented reality technologies into graphic design. These recommendations include the following:

1. Encouraging educational institutions to employ augmented reality applications in the educational process: It is important for educational institutions to adopt augmented reality technologies within learning environments, especially in technical disciplines such as graphic design, to enhance the learning experience and make it more interactive and realistic.
2. Using augmented reality at all educational levels: Given the significant benefits offered by this technology, it is recommended to expand the use of augmented reality at all educational levels, including university education, particularly to address the problem of overcrowded classrooms, which can hinder the effectiveness of the educational process.
3. Encouraging teachers to use augmented reality according to different learning styles: It is essential that teachers are trained on how to integrate augmented reality technologies in a way that is compatible with different learning styles, whether visual, auditory, or kinesthetic, to meet the diverse needs of students and enhance the learning experience.
4. Emphasize active learning and social constructivist learning theories when designing graphic design course activities: The researchers recommend applying active learning and social constructivist learning strategies when designing student activities and projects in graphic design courses. These strategies help motivate students and create an interactive learning environment that encourages critical thinking and problem-solving.
5. Emphasis on behavioral and constructivist learning theories: It is important to employ behavioral and constructivist learning theories when teaching students in an augmented reality environment. These theories should focus on processing information and knowledge in an interactive and dynamic manner, enhancing students' understanding of concepts and encouraging continuous interaction.

5.2.1. The Importance of Using Augmented Reality Technology in Graphic Design

Graphic design is a rapidly changing field, with its tools and technologies constantly evolving, including the integration of technologies such as augmented reality. This technology can add a new dimension to graphic design, allowing designers and students to create more interactive and immersive experiences. Therefore, it is highly recommended that augmented reality technologies be incorporated into technical education curricula, enabling students to learn new skills related to future technologies and prepare them to compete in the job market.

5.1.2. The Interaction Between Technology and Art

The clear relationship between technological developments and art demonstrates the need to embrace modern technology and employ it in the arts. Art educators in general must be prepared to teach students how to use modern technologies, such as augmented reality, in a practical and effective manner.

5.1.3. The Importance of Augmented Reality in

Teaching Digital Arts

The researchers recommend the use of augmented reality technology in digital arts education, particularly in graphic design. The technology not only helps improve the quality of artistic production but also contributes to developing students' creative thinking skills, increasing their capacity for innovation, and giving them the opportunity to explore new avenues of artistic expression.

5.1.4. Expanding the Use of Augmented Reality in Other Areas of Art

Moreover, augmented reality is useful in other areas of art education, such as sculpture, sculpture, crafts, ceramics, and installation arts. Therefore, art educators should pay greater attention to this modern technology and work to integrate it into the curriculum to enhance interaction with artworks and expand the horizons of art education.

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