ENHANCING AFRIKAN VISUAL DESIGN LEARNING THROUGH VIRTUAL REALITY

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ABSTRACT

As the world transitions from the information age to the experience age, Afrikan visual design learners confront significant obstacles. Lou (2017) opines that the visual design traditional teaching approaches are ineffective and not exciting to visual design students of the digital era. They are inert and indifferent; therefore, learners fail to see the relevance of what they are learning in real-life settings. Additionally, significant visual design abilities such as, abstract concept visualization, design thinking and creativity are proving difficult to teach. It is consequently vital to prepare these design learners to fit in the evolving world. Virtual reality allows for a simulated environment in which teachers and visual design students can engage in hands-on learning, group projects, discussions, field trip and concept visualization, hence it is a game-changer in solving these educational issues. Within the restrictions of system operation, learners and instructors can create anything they want and then become a part of it. With an aim to make up the deficiency of traditional training mode, this paper advocates for the integration of VR in the visual design courses by constructivist learning. This will stimulate visual design students' enthusiasm for study and learning motivation, arouse visual design students' imagination, creativity and sensibility and improve visual design students' overall design capability. Having a grasp at this method of learning, the Afrikan digital learner will comfortably fit in the changing world. Thus, the research objectives are to seek for virtual reality and allied systems, appropriate visual design learning paradigm, constructivism and virtual reality for teaching visual designers and application of virtual reality in visual design learning.

Keywords: Virtual reality, Visual design, Digital age, constructivism learning

1.0 INTRODUCTION

According to Yildirim et al. (2020), today's digital design students enter higher education with substantial computer expertise and increasing expectations from academic institutions. They expect that higher education will expose them to relevant technologies for their successful transition into the industry. Learning visual design is not just about creativity; it also depends on the artist's ability to use the correct tools and materials, lack of such skills and resources may have an impact on the final product. A student's inability to get the tools and resources he or she needs to complete his or her studies has an impact on the learners' attitudes about learning. Academic institutions are faced with the problem of developing adequate solutions to address the demand for innovative education as a result of these factors (Yeo and Cao, 2021). Furthermore, the economy and industry have been directly impacted by fast advances in scientific and technological domains. As a consequence of this transformation individuals are expected to have new abilities such as critical thinking, creativity, problem-solving, and virtual cooperation, unlike what the corporate sector required before. Workers' demands have sparked worldwide educational reform campaigns. Teachers' and visual design students' responsibilities have also shifted as a result of educational innovations. Teachers' workloads have altered as a consequence of the pressures placed on their shoulders by schools (Yildirim et al., 2020). Teachers' vital talents and tools in contemporary education have become technology, digitalized materials, media, and equipment. The learning successes and convenience given by such instruments are referred to as e-learning, m-learning, and u-learning, respectively(Hu et al., 2016).

Through successful routes and techniques, such teaching strategies or models concentrate on building and growing the enthusiasm and creative teaching talents of visual design students for a new learning topic. To familiarize visual design students with technology systems, ideas and information are often taught verbally and via visuals in conventional instructional methods. Lessons would be tough and boring as a result of this (Huang and Liaw, 2018). To counteract this challenge, inclusion of virtual reality in teaching scould reinforce the reciprocity of learning contents and allow users to truly view potential interactions and construct technological systems for the appearance design, material behaviors, structural combinations and functionality of technological products. As a result, visual design students will have a greater understanding of visual design (Hu et al., 2016).

2.0 VR AND ALLIED SYSTEMS

2.1 Virtual Reality

Virtual reality, as defined by (Sherman and Craig, 2002), is a medium comprised of interactive computer simulations that detect the participant's location and activities and substitute input to one or more senses, creating the impression of being psychologically immersed or present in the simulation (a virtual world). This might be shown in a blank room, on a headset, or on any other device that enables the user to feel present in the virtual world. Some virtual reality systems include elements such as sound or touch feedback that enable users to interact with objects and environments. By enabling humans

to engage with digital objects using their sense of touch, haptic technology opens up new possibilities. Haptic technology, also referred to as kinaesthetic communication or 3D touch, is any technology which creates capability of touch by applying forces motions or vibrations to the user.

2.2 Augmented Reality

Augmented reality is a technique that aims to improve the virtual reality experience by combining real-world aspects with virtual ones. Sounds, feelings, and visuals created by a computer system are examples. Augmented Reality enhances the user's vision and engagement with the actual world by bringing virtual information or objects to any indirect view of the user's real-world surroundings. Augmented reality, unlike virtual reality, does not produce a synthetic reality. Instead, it takes a real item or environment and adds contextual data using technology to help visual design students grasp it better for example Snapchat lenses and the game Pokemon Go (Gebretsadik et al., 2014).

2.3 Mixed Reality

Real-world and digital items interact in mixed reality (MR), which combines features of both AR and VR as shown in figure 1 below. Mixed reality is just now beginning to gain traction, with Microsoft's HoloLens being one of the most renowned early mixed reality devices (Atanan et al., 2017).

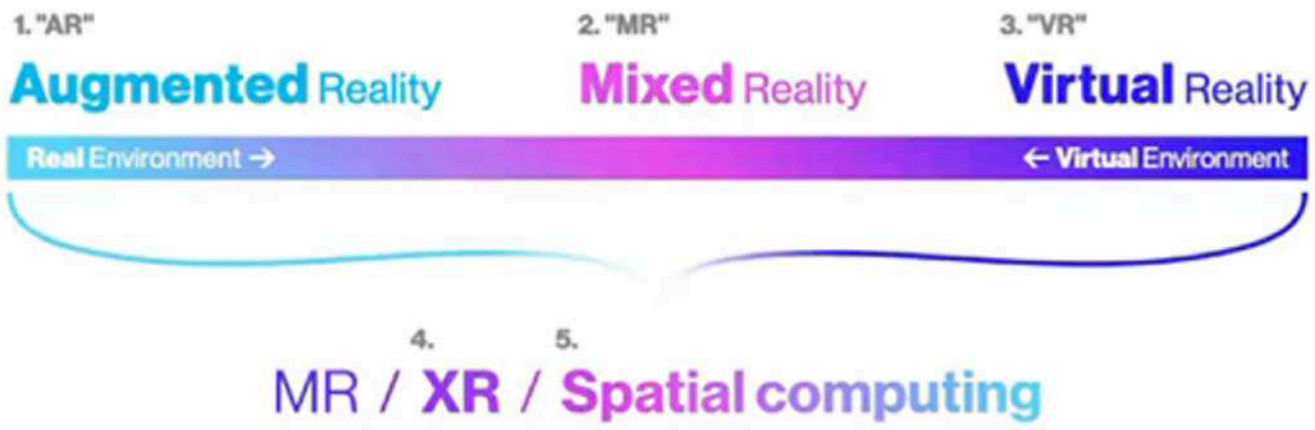

Figure 1 VR and Allied Systems. Muehlhaus, (2020)

3.0 VISUAL DESIGN LEARNING PARADIGM

To study the applications of VR in higher education, a knowledge of existing learning paradigms is required. The distinctions between behaviorism, cognitivism, and constructivism have been made in the literature of Jen Chen cjchen, (2010). Experiential learning is also mentioned by Kolb et al., (2014), connectivism has recently been offered as a new learning paradigm (Goldie, 2016). Various perspectives concerning educational aims and results have emerged as a result of each learning paradigm. Each of these theories provides a unique viewpoint on learning objectives, motivation, learning performance,

information transfer, the role of emotions, and implications for teaching approaches (Jen Chen cjchen, 2010).

Visual design students may use a virtual environment to control and interact directly with items in the virtual world. Control and engagement, as well as unrestricted investigation, create a higher sensation of power. Smith et al. (2007) describe the learner as feeling "free and powerful." It also allows for self-pacing and repetition. All of these elements contribute to motivation, which is an important aspect of learning. This aligns with constructivist learning environment concept, which emphasizes the necessity to give learners responsibility for the learning process in order to generate understanding (Huang et al., 2010)

3.1 Constructivism Learning

Learners take an active part in their learning under a constructivist paradigm because they not only absorb material, but also link it to previously absorbed knowledge to generate new knowledge (Huang and Liaw, 2018). Constructivist ideas are crucial to our understanding of learning in virtual reality, according to a growing collection of research (Atanan et al., 2017). Colliver, (2002) opines that, education's primary goal is to improve the learner's thinking abilities. A student who is not motivated will not see a design problem, subjects should be chosen based on the learner's interests. This is the theoretical basis for virtual reality learning. Virtual reality technology displays a wide range of unique features that showcase outstanding technological achievements. This technology is continuously advancing and gaining new capabilities, which may one day allow for the development of new learning experiences and possibilities (Allcoat and von Mühlenen, 2018).

Indeed, the introduction of virtual reality technology into education creates enthusiasm and high expectations for its possibilities among instructors. However, it is vital to remember that this technology is just a tool to aid in the learning process, which must be properly and efficiently applied.

3.2 Constructivism and Virtual Reality for Teaching Visual Designers

Knowledge is formed by an individual's interaction with the environment, according to the constructivist ideology. The essential principles of this theory have been around for more than a century, with Jean Piaget and John Dewey among the first to articulate them. Constructivism as a learning theory emphasizes the combination of inputs from the senses, existing knowledge, and new information to develop new meaning and understanding through active, authentic, cooperative, and reflective learning activities (cjchen, Jen Chen, 2010). Virtual reality is listed as one of the technologies that may help students study constructively. Virtual reality creates a controlled environment in which students may travel and manipulate virtual objects while seeing the results of their actions in real time. As a result, virtual reality is particularly adapted to offering exploratory learning settings in which learners may learn via trial and error. In general, constructivists think that learners learn more effectively when they are actively participating in the construction of information in a learning-by-doing environment (Allcoat and von Mühlenen, 2018). The properties of virtual reality and the axioms of constructivist learning theory are completely consistent, according to (Huang and Liaw, 2018), and constructivist theory offers a legitimate and trustworthy foundation for a theory of virtual reality learning.

Previous researchers have identified perceived self-efficacy, interaction, and motivation as

essential components in establishing a constructivist learning environment, according to Allcoat and von Mühlenen (2018). As a result, perceived interaction is a critical aspect in improving learners' problem-solving abilities. Because much of the information taught in schools may not be retrievable in real life, many educators use a variation of problem-based learning to encourage learners to solve issues by sketching them (Amineh and Asl, 2015). Virtual reality technologies enable the creation of synthetic real environments capable of replicating reality's many sides (Atanan et al., 2017).

3.3 Perceived self-efficacy

Self-efficacy is a learner's conviction in his or her ability to complete a task and achieve a goal (Hornik and Johnson, 2014). Self-efficacy is characterized as a "generative competence in which cognitive, social, and behavioral subskills must be arranged into integrated courses of action to fulfill numerous objectives" (Nissim and Weissblueth, 2017). In e-learning contexts, a high level of perceived self-efficacy correlates to higher learning performance and behavioral retention (Huang et al., 2010). As a consequence, self-efficacy has an impact on learners' learning attitudes, skill development, activity selection, and long-term desire to study.

3.4 Perceived interaction

Virtual reality is a 3D graphics system with various interface devices that immerse the spectator in an interactive virtual world Chittaro and Ranon, (2007). Learner-environment interaction, according to Bogusevschi et al., (2018), comprises of learners using a variety of strategies to create and change virtual environments. Learners engage with virtual reality settings using customized interfaces that enter instructions into the computer and offer feedback from the simulation. Through a range of sensory pathways, the style of engagement is meant to be as intuitive as possible. The student, on the other hand, may engage with the learning material by employing scale functions, which enable the learner to vary the size of the virtual world's 3D objects and change the scale of the virtual environment (Rohaya et al., 2012). Learners engage with the environment and learning items in real time at the same time. To generate realistic learning experiences, information may be given in replicated real-life settings and relevant circumstances. Authentic material from the learner's everyday life is a key aspect in encouraging reflective thinking. Learners may engage with the simulated world in virtual reality learning settings, allowing them to learn and solve issues via an immersive and participatory experience (Chittaro and Ranon, 2007).

3.5 Learning motivation

Jen Chen cjchen (2010) proposed that attention may be acquired in two ways: (1) perceptual arousal increases interest by presenting fresh, startling, incompatible, and unpredictable occurrences; (2) inquiry arousal catches interest and motivates involvement in questioning or problem solving. Relevance ensures that a learning process is relevant to the learner's needs and objectives, boosting motivation. This notion highlights the importance of learning being linked to the learners' own experiences and vital to their future learning. (Paszkiewicz et al., 2022) opines that learners should obtain competence and achievement as a consequence of their talents, according to confidence. Teachers should create adequate performance standards and evaluating criteria in order to attain their learning goals. The promotion and support of learners' intrinsic pleasure of the learning process, as well as extrinsic incentives for

achievement, are referred to as satisfaction.

4.0 APPLICATION OF VR IN VISUAL DESIGN LEARNING

4.1 Visual Design Education

The pedagogic approach to visual learning is mostly based on the conventional design studio setting, in which individuals or small groups collaborate on a particular brief under the supervision of a creative director, in this instance the students' instructor. This approach of interacting in a studio-like setting has shown to be beneficial in terms of student pleasure as well as preparation for a career in design. The scholars are given a project brief, similar to what they would get in the workplace. The students follow the project brief's instructions for doing research and developing design ideas all the way to the completed product. The classroom would be set up similarly to a regular studio, with its own area and standard equipment. Like in the design profession, the students are thoroughly involved in the practical work and fully participate in all teacher–student and student–student exchanges. They would go through the design process with formative conversations and peer and instructor critiques. While this approach is effective, it is based on a classic visual design business model that does not take into account newly developing forms of global networking and new technologies that are affecting the sector (He and Zhu, 2022).

Higher education should prepare African visual design students for the future of the industry they will work in after graduation and beyond. These learners need to be taught how to manage a fast changing environment, as Gachago et al., (2011) argues. However, recent lecturers and student polls from the Ghana and South Africa all show that there is a gap between how new technologies are integrated into students' social life and how they are employed in formal education (Africa et al., n.d.; Students ' Preparedness towards the Study of Graphic Design : The Case of UEW, 2021)

A broad range of technologies, such as smart phones, computers, tablets, and gaming devices, may be available to today's student. Visual design students, in particular, use a range of online and social media channels to engage with their classmates, and they often update their online accounts while sharing new designs and photos they have developed. Many educational institutions have begun to investigate the usage of student-owned devices in the classroom Parsons, (2013) a practice known as BYOD (Bring Your Own Device). However, as Mac Callum and Day, (2015) points out, BYOD educational strategies have numerous implications. "If institutions choose to work with student-owned devices, they would increase their capacity to deliver inclusion with innovation, but the transformation would be difficult". As a result, a successful BYOD strategy that aligns student learning settings with new and evolving graduation objectives necessitates a curriculum that has been thoroughly revised Allcoat and von Mühlenen, (2018) With these concerns in mind, the researchers decided to investigate the application of Virtual reality emerging technologies in the visual design curriculum. Along with the widespread use of mobile devices, these two technologies are expected to have a significant impact on the visual design industry (Danny Munnerley et al., 2014).

4.2 VR as a Tool for Conceptual Visual Design

Various ways for employing virtual reality as a design tool exist and have been studied in academia Bartosh and Anzalone, (2019) One technique is to make preliminary 3D drawings with 3D sketching applications like Google Tiltbrush, which may then be converted into traditional modeling software for further development. This approach enables for full-scale design manufacturing, but the user must still digitally translate the drawing. The most frequent way is to do the digital modeling before exporting it into a virtual environment and walking through it in full size. This way of modeling with VR for visualization enables visual design students to create material using tools that they are already acquainted with, which simplifies the VR integration learning curve.

4.3 Virtual Prototyping

It is the process of creating a digital output that represents a model of a component or system that will be built throughout the design phase. Virtual prototyping (VP) provides a lot of advantages to visual design learners in making decisions and fixing flaws during the design stage. Physical prototypes are costlier, take longer to complete, and are difficult, if not impossible, to change. The requirement for natural contact and for the prototype to have the same characteristics and qualities as the actual items is highlighted in these applications, which rely on tactile input (Rohaya et al., 2012).

Gebretsadik et al., (2014) opines that usability testing are traditionally done after the physical prototype in visual design creation; however, with the integration of Computer Aided Design -VR device throughout the product design development process, it is now possible to test and assess usability without incurring prototyping costs.

4.4 Effectiveness of Virtual reality in Visual design learning

There is a great possibility to develop and study the use of virtual reality in schools, as Ausburn, Floyd B.; Ausburn, (2008)point out. VR is a high-interest technology with a lot of promise in terms of education and career training. Visual designers may now employ virtual reality technology in the classroom with ease, both technically and financially. According to the findings of a survey conducted by Smith et al., (2007) virtual reality has a good influence on student design, graphical communication, and spatial ability. Students are also enthusiastic about adopting virtual reality in the classroom. The usage of virtual reality (VR) may benefit students and faculty members in generating chances to exchange ideas and see items, as shown by the research study. It is also evident that merely installing the new equipment in classrooms would not enough in making good use of VR technology. To successfully integrate technology into meaningful learning experiences, much work is required. (Smith et al., 2007) Another study conducted by (Megat Zakaria, 2020) offers the means and standard deviations for students' responses to survey questions on their perceptions of virtual reality usage. Students were given a series of questions on their impressions of virtual reality and the course's teaching materials. Students agreed with all elements related with a favorable opinion of virtual reality and the course's educational resources, according to their responses. Students also said the VR program was engaging, simple to follow, offered a clear comprehension of the subject given, and was a preferred learning approach. Students pointed out that using VR had benefits over traditional learning techniques. Students agreed that seeing a 3D environment in VR is easier than viewing it on a flat computer screen meaning that learning using VR is more interesting than studying from books or lectures, and that if VR programs were accessible, they

could learn more in other disciplines Students also disagreed that learning multi-view projections using 2D graphics rather than VR 3D simulation was preferable (Megat Zakaria, 2020).

Students agreed that the course improved their abilities in a variety of areas, including product design and graphic communication. Students also said that they felt more confident in their 3D visualizing abilities. Students said that they did not find the course to be frustrating and that they intended to continue in the program. Students gave the course a reasonably high rating for course satisfaction, stating that they were totally interested in the lesson and that the 3D VR education offered in the course was enjoyable. Furthermore, students believed that the lesson enhanced their learning style (Megat Mohd Zainuddin et al., 2009).

5.0 CHALLENGES OF VIRTUAL REALITY AS A LEARNING TOOL

Besides the good that a simulated environment brings to a learning scene, it is imperative to also point out some of the drawbacks that it faces as well as pose to its users.

Smith et al., (2007) observes that several scholars have identified issues that are impending current VR research efforts. Lack of necessary computing equipment for testing VR applications, lack of standardization for VR systems, difficulty establishing equivalent control groups, and lack of solid theoretical frameworks for both design and evaluation of VR are just a few of the challenges. Developing research based on experimental comparisons of VR-based and traditional instruction techniques, carefully controlled trials and comparisons of specific VR applications, and longitudinal analysis of VR use in classrooms is difficult due to these challenges. Jen Chen cjchen, (2010) for example, noted that no empirical study has been done on the implications of applying system-modeling cognitive tools (Hicks, 2016) for visualizing issues on problem-solving performance.

On the other hand, Purwar, (2019) expresses that, Virtual reality has the ability to produce mismatches between physical and visual motion signals, resulting in 'simulator sickness.' Closeness of the screen to the user's eyes, switching from a dark to a bright picture may cause pain while the user adjusts to the new brightness level.

Challenges that may occur in classroom

According to Hicks, (2016) virtual reality may pose the following challenges to learners:

5.1 It destroys human bonds

While virtual reality can be a useful tool in many fields, it can also be a significant disadvantage. The basis of traditional education are genuine human encounters and interpersonal bonds. Virtual reality differs from other forms of virtual reality in that it is just the user and the software. This could have a negative impact on student relationships and human communication in general.

5.2 An inability to adjust

Utilizing a virtual reality headset differs from using a regular classroom where one may be more flexible, ask questions, and get answers. If one is using specialist software designed to work in the same manner, they will not be able to do anything other than what they are supposed to do.

5.3 Functionality problems

Things may go wrong with written software just as they might with any other application. When something goes wrong with the tool, students' learning is put on hold until it is repaired which might be both pricey and inconvenient. As a result, if a learner has exams the next day and their virtual reality headset breaks, he or she will be unable to study and pass the test. This was only a hypothetical situation; anything might happen at any time.

5.4 Internet Use Is Compulsive

It is also feasible that learners may develop an addiction to their virtual environment. Individuals' reactions to video games and stressful situations have been studied.

5.5 It is rather costly

Advanced technology is usually prohibitively expensive. If VR is to be extended to reach all learners, a lot of money has to be spent. Furthermore, only the rich will have access to modern training that incorporates virtual reality.

6.0 METHODOLOGY

This paper is based around existing literature and current practices on application of virtual reality in visual design learning. Data was collected from a variety of sources to bring together knowledge of the four research dimensions: visual design learning paradigms, application of virtual reality to transform visual design educational practices, challenges and effectiveness of virtual reality in visual design in order to provide knowledge for educational researchers and professionals and apply them in the field of education. A plethora of data was collected from research articles, review papers, books and book chapters, all from a variety of authentic search engines with the help of internet as well as books available in library. The search engines used for this present review include Google, Google Scholar, IEEE Xplore and other digital libraries.

Following thorough study of the available literatures, findings were reported systematically. A full bibliography of information sources reviewed is given in the references section.

7.0 CONCLUSION

This research addressed how virtual reality technology, when used in conjunction with constructive learning, might provide potential assistance for visual design education. The ability to allow learners to visualize and interact with a three-dimensional virtual representation, experience the virtual environment in real-time, visualize abstract concepts, articulate their understanding of phenomena by constructing or manipulating virtual environments, visualize the dynamic relationships between several variables in a virtual environment system, and obtain an infinite number of viewpoints of a virtual environment system are just a few of these capabilities. With such capabilities, some of which are unique to this technology, virtual reality provides several educational advantages that, if properly applied, will have a good influence on its educational use.

There is a pressing need to raise public knowledge about the advantages of these technologies

so that they may be widely adopted, as well as highly user-friendly approaches for VR application by beginner designers. There is a need to raise awareness among tutors, researchers, scientists, engineers, and others, which might be accomplished by holding events seminars, conferences, workshops, and other events based on real-world application case studies, such as those detailed in this paper.

Virtual reality offers a controlled environment in which visual design learners of the digital age can access and modify the virtual objects embedded within it, and more significantly, the results of such communication can be experienced in real time. The VR learning environment is intuitive and engaging; it is a shared information context with unique interactivity that can be tailored to meet different learning and performance styles. Having a grasp at this method of learning, the Afrikan digital learner will comfortably fit in the changing world.

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