Perspectives on the Use of Virtual Reality Applications in Teaching and Learning

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ABSTRACT

Virtual reality (VR), a computer-generated three-dimensional environment, improves Gen Z students' learning experiences by allowing them to engage and modify perception using sensory input. Nonetheless, studies have shown that the traditional teaching method which is still used by most lecturers, is harder for students to understand compared to a mix of verbal and visual techniques. Hence, many educators think higher education should move beyond traditional teaching methods in imparting knowledge in formal settings. The present study explores lecturers' perspectives on the use of virtual reality as a teaching method, with the aim of identifying its benefits and challenges. Four lecturers from three faculties were interviewed. The responses were transcribed and analysed using thematic analysis. The findings revealed that they believe that VR creates immersive courses motivates students to experiment, aids in understanding abstract concepts, offers a new learning method for teachers, enables students to retake lessons, and enhances effective teaching by providing hands-on experience. The lecturers also revealed the challenges of integrating virtual reality into classroom learning related to adaptation to the technology, students' computer and internet skills, cost for VR equipment and infrastructure, and health risk due to the use of VR. The study highlighted the benefits and challenges encountered, as well as the steps to be taken to address the problems. The concerns raised by instructors indicate specific challenges regarding the use of VR in UTeM that must be addressed by the proper authorities, including Deans, lecturers, and the government, in order to improve teaching and learning.

Keywords: Virtual Reality, TVET, Teaching innovation, Malaysia, pedagogi

INTRODUCTION

The study explores the use of virtual reality as teaching tools with the aims of identifying the benefits and the challenges from the perspectives of the lecturers from among the three faculties who are involved in the teaching at Universii Teknikal Malaysia Melaka (UTeM). The three faculties are Faculty of Electronic and Computer Technology and Engineering, Faculty of Information and Communication Technology and Faculty of Technology Management and Technopreneurship.

VR is a computer-generated, three-dimensional virtual environment in which users may interact. It is often accessed by a computer capable of displaying 3D information onto a display, which can be separated screens or a wearable display, such as a head- mounted display (HMD), in conjunction with user identification sensors (Hamad & Jia, 2022).The technology has advanced tremendously over the years, and although its popularity on gaming platforms is well known, it is also gaining ground in education, training, and healthcare. It is the result of decades of technological and microprocessor advancements that enabled high-level processing at a reasonable cost. This has created greater chances for lecturers to embrace new tools and enhance the learning experience for incoming students who are tech savvy generation (Anith Khairunnisa Ghazali et al., 2024).

Virtual reality (VR) has various advantages for university teaching approaches, including increased engagement, impact, and accessibility for students. First, it improves engagement and memory. It generates immersive courses that capture students' attention and make them feel as if they are actively engaged in the content. Studies have found that VR encounters can increase knowledge retention when compared to traditional learning approaches.

Furthermore, virtual reality in education may improve accessibility and create new learning possibilities. VR enables students to virtually go to locations or experience circumstances that would be difficult or costly in the real world. This offers up opportunities in fields such as history, archaeology, and even healthcare, where students may virtually tour historical places, dissect a virtual frog, and practise procedures in a safe, simulated setting. VR has a notable benefit in education as it offers to improve understanding of complex concepts. VR can break down complex concepts into easily digestible visuals and interactions. This can be particularly helpful in science, engineering, or abstract subjects where spatial reasoning or visualization is important.

The use of virtual worlds as teaching aids in the field of education has been increasingly widespread in recent decades. This is consistent with the introduction of the 5G era, which resulted in VR or virtual reality entering our lives (Lin et al, 2023). The constant advancement of science and technology has also resulted in VR technology making significant progress and eventually becoming a new branch of research and technology.

In Malaysia, the COVID 19 outbreak has prompted Malaysians to make the best use of technology. When all schools and universities were shuttered due to a Movement Control Order (MCO), instructors at schools and higher education institutions were forced to teach online. When the COVID emergency ended three years later, activities resumed as usual; nevertheless, the usage of technology during covid had an influence on the education scenario, notably at the university level. The use of technology is becoming increasingly common, and there are several approaches and possibilities for using technology in education. One of these technologies is virtual reality. However, examination-based learning has been ingrained in Malaysia's education system, with learning occurring through good results and outstanding performance in important national examinations. This system continues to exist in higher education (Md Shamsudin & Md Yunus, 2022).

The conventional/traditional teaching approach are still employed by majority of the lecturers in the teaching and learning process. This outdated teaching approach is not aligned with the advance of technology and the phase of the 4th Industrial Revolution. Adnan (2020) argues that “the formal education system needs to step up its’ game to meet the needs of ‘Generation Z’ and the incoming ‘Generation Alpha.” Due to this fact, the teaching methodologies in tertiary institutions should no longer rely solely on traditional and rigid methods to impart knowledge within formal settings. Adnan et.al (2020), Wong et. al. (2020), Ghaliya Al-Farisi et. al (2021) and Anith et al (2024) suggest that Virtual Reality or VR be adopted for instructing and learning in higher education. Figure 1 presents the continuum from rigid and formal education mediums to more interactive and immersive ones at the present time (Adnan, 2020).

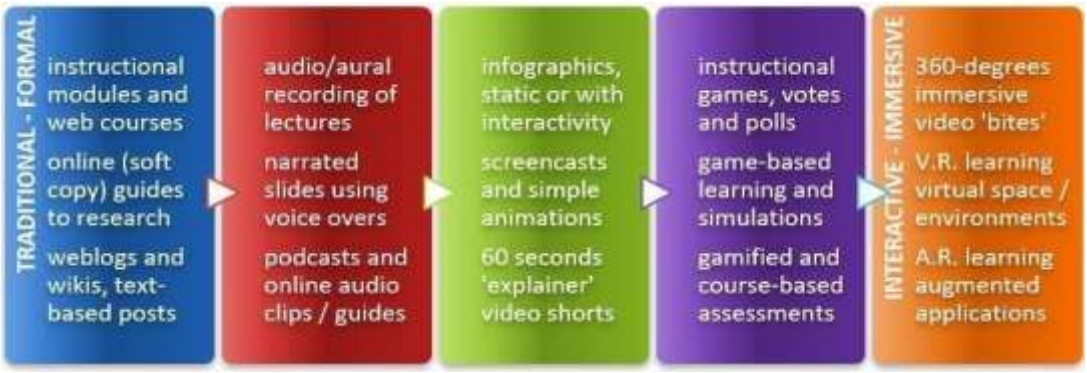


Figure 1 : The Continuum from Traditional-Formal to Interactive-Immersive Educational Mediums

UTeM as a technical university with engineering as one of its important undergraduate programme would benefit much from the use of virtual reality (VR) in several of its engineering classes to enhance teaching efficiency, transferring of skills and students’ understanding of engineering subject. Hence, this research is

undertaken to ascertain the perspectives of the major players who have conducted or will conduct and facilitate the use of VR in the classes i.e. the lecturers. Numerous studies have focused on instructors' perceptions towards the use of VR technologies in their classrooms (Raja & Laksmi, 2020., Wong et al., 2020., Udeozor et al., 2021). Still, there is a need to conduct similar studies in Malaysian context to understand their perspectives as the results could vary according to the context and specific aims. Literature review highlights the benefit and challenges of using VR in engineering subjects employed in local and foreign universities. Nevertheless, do UTeM lecturers experience the same positive impacts when VR is employed in their classes? What challenges do the lecturers face in their classes which utilising VR facilities? What difficulties do the lecturers face to assist their students coping with the use VR in class so as to fully utilise VR to increase effective teaching and learning? These are some of the questions the researcher explores to identify the benefits and challenges which the lecturers have experienced or may encounter. Finding answers to these questions are important not only in terms of enhancing the teaching and learning but also to commensurate the cost invested taken to equip classes with VR facilities.

LITERATURE REVIEW

Virtual Reality in Education

Education is often defined as the process of aiding learning, acquiring information, skills, or good values with the aim of preparing students for life and employment. This is done by teaching them the information and skills that society requires. Classes frequently break down into two parts: theoretical and practical, which include exercises, laboratories, and internships. Theoretical courses involve information transfer in the form of lectures to a large group (Wittich et al., 2017). Over time, the demands of students and the employment market compelled modifications in the educational system. The practical aspect had been prioritised particularly in technical fields in line with Confucius' insight, "Tell me and I forget, show me and I may remember, let me take part and I understand"(Kaminska et al., 2019). Many students struggle to grasp difficulties, particularly in technical classes, due to their technical complexity, the need for abstract thinking, and the fact that the concepts are not totally noticeable (Anith Khairunnisa Ghazali et al., 2024, Roberts, 2019). Basic problems hinder future development and research of more complex challenges.

Numerous examples of excellent hardware and software in educational processes show that the educational technology sector may improve learning results for the majority of students (Zhang et al. 2018). More and more educational institutions across the world are implementing sophisticated new technological tools to assist them fulfil the demands of diverse student populations. Traditional books are being replaced by digital instructional content (particularly open educational resources). It is well acknowledged that the usage of information and communication technology improves student attitudes towards learning (Lazar & Panisoara, 2018). It is a fast expanding field of study, constantly developing and seeking new technical solutions. Over the last several years, Virtual Reality (VR), which provides an interactive computer-generated world, has expanded beyond the field of gaming to professional development such as military, psychology, medicine, and education applications.

VR is a powerful tool in supporting learning and teaching process. Many studies (Slavova & Mu, 2018., Adnan, 2020., Udeozor et al., 2021., Hamad & Jia, 2022., Anith et al., 2024) reveal that most students remembered what they saw in VR and concluded that VR is a more memorable environment than laboratory-based demonstration.There are numerous classifications of VR technologies used in education field. Two of VR classification systems, the first by Leung et al. (2018) and the second by Muhanna (2015) are presented. These systems are common VR technologies used by instructors at tertiary education. Leung et al. (2018) identified the 5 types of VR systems commonly used in education and research. These include Immersive, Desktop, Collaborative, Projected Reality, and Telepresence.

The wearers are equipped with a head-mounted display, trackers, and input devices that work and are immersed in several channels. The head mounted displays are adjusted directly in front of one or both of the wearer's eyes using a head mount. Digital content is then superimposed on his field of vision. In the second type, Desktop VR, the system displays a virtual environment in two (2D) or three dimensions (3D) on a computer screen instead. Despite the removal of the immersive feature, the user may still experience the virtual

world in first-person by freely exploring the area and interacting with it via a controller such as a joystick or a conventional computer mouse.

Collaborative VR is often implemented on immersive or desktop VRs, is a multi-user virtual world in which players interact with one another via avatars, such as monitoring each other's movements, gestures, emotions, and noises. The fourth, projected reality offers a second-person experience in which the user stands outside yet sees oneself as a part of the virtual environment projected onto a computer display. A video camera acts as the input device, and users utilise it to watch themselves inside a computer-generated virtual environment displayed on a screen. Finally, telepresence enables people at one site to operate a robot or other equipment at a remote location. This is accomplished by employing a number of technologies, including cameras, microphones, and tactile and physical feedback, to replicate the sensation of being in another area.

Muhanna (2015) stated that a system that lacks any amount of mental immersion should not be regarded as a VR system. She further classified VR systems into three levels of immersion:(i) the lowest level applies to basic VR systems; (ii) the higher level, experienced in partially immersive VR systems; and (iii) the highest level, experienced in fully immersive VR systems. Figure 1 depicts a graphical structure of the taxonomy.

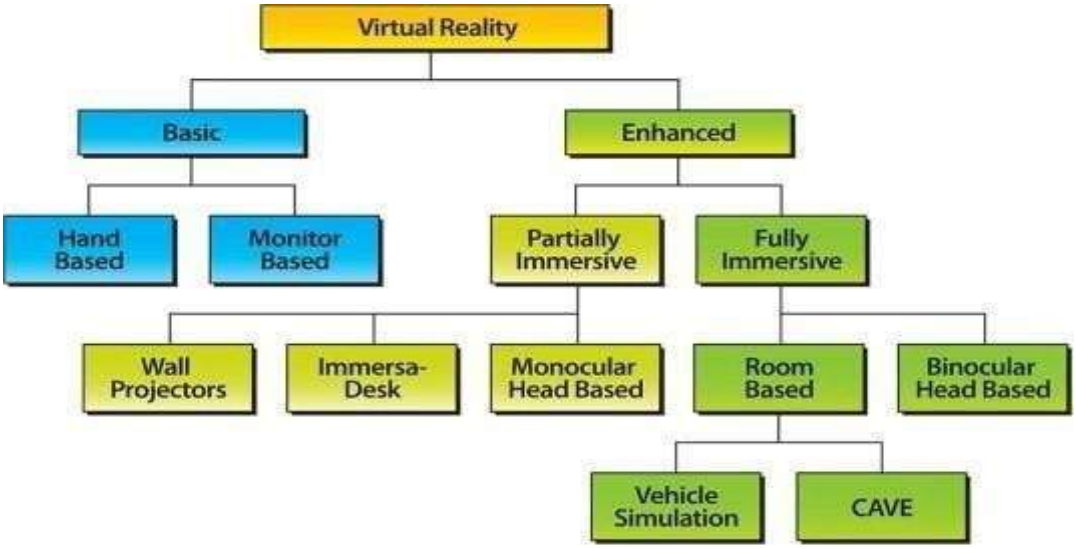


Figure 2: Taxonomy of VR Systems

In the context of Malaysian education practices, a study conducted by Md. Shamsudin and Md Yunus (2022) show that overall enhanced head-mounted displays were the most commonly used immersive VR technology.

Benefits of the Use of VR technology in Education

Virtual reality (VR) has considerable pedagogical potential to enhance teaching and learning by providing immersive, interactive, and experiential learning environments. Through simulated environments, students can explore and manipulate virtual objects, observe the consequences of their actions, and participate actively in learning activities. These features are consistent with constructivist and situated learning theories, as well as the concept of learning by doing, which emphasises knowledge construction through active participation and interaction with the learning environment. A review by Leung et al. (2018) and Radianti et al. (2019) highlighted the potential of VR to promote active engagement and improve knowledge retention. Similarly, Rahman et al. (2023), in their study of young people in Shah Alam, Selangor, Malaysia, found that hedonic motivation was an important factor influencing behavioural intention towards VR adoption and use for learning.

Another benefit of VR is its ability to provide access to learning experiences that may be difficult, costly, or impractical to arrange in real-world settings. Through virtual simulations, students can explore unfamiliar locations, examine complex structures, and practise procedures in a controlled environment. Such opportunities are particularly relevant to technical and engineering education, where practical experiences and

the visualisation of complex concepts are important. The use of simulated environments also aligns with constructivist and experiential learning principles, as students can interact with virtual objects and learn through experience (Yahaya et al., 2024).

The immersive and multisensory features of VR may further support students' motivation, understanding, and retention of knowledge by enabling them to interact with visual and auditory information and manipulate objects within a simulated environment. In a review of 100 studies on VR in higher education engineering, Soliman et al. (2021) reported benefits associated with students' understanding of engineering-related concepts and the development of constructivist learning environments. Nevertheless, the educational value of VR depends on how effectively its technological features are integrated into pedagogical activities and aligned with the intended learning outcomes. Therefore, VR should be considered a complementary teaching approach that provides opportunities for active and experiential learning rather than merely a technological alternative to conventional instruction.

Challenges of the Use of VR technology in Education

One of the issues is health risks pose to the students using the VR devices. VR devices is placed close to the eyes with screens positioned within 10 cm and VR devices typically require a fixed focus at a specific distance. Given the direct exposure of the eyes to the emitted light during extended VR sessions, it is crucial to consider the potential implications for eye health (Marougkas et al., 2023). Soliman et al. (2021) analysis of literature review of 100 studies on the use of to using VR show that students experienced dizziness, feelings of fullness, and difficulties concentrating after being exposed to the VR environment. Other symptoms that users can experience include eye strain, headache, perspiration, nausea, vomiting, and disorientation. Chang et al. (2020) describe these health risks related to the use of VR as cybersickness or simulator sickness which can arise from a mismatch between the visual, vestibular and proprioceptive sensory systems. Chang et al, (2020) maintain that these negative aspects should be acknowledged and addressed when proposing methodologies for the use of VR so that suitable strategies can be developed to mitigate the potential health risks. This may involve designing VR experiences that minimize eye strain, incorporating regular breaks or utilizing technologies aimed at reducing the risk of cybersickness.

Another identified challenge is that the equipment can be very expensive and difficult to use. VR equipment demands a certain technical expertise, and it can be challenging to get a hold of relevant content. The students must usually share VR equipment, which requires logistics and good planning. In addition, it may be difficult to acquire relevant software, since much of the software is based on single experiences, rather than learning through progression (Chang et al., 2020; Jensen et al., 2018). Wong et al. (2020) conducted a survey to determine the trend, acceptability level, advantages, and problems of integrating VR applications in Malaysian tertiary education reported that although the acceptance rate of VR is high among university students, Malaysian tertiary education has major hurdles, including technological issues and instructors who lack strong technical abilities owing to a lack of expertise. Soliman et al. (2021) also highlight the challenge in development of a VR application that it takes time and requires experience in the software and code, since the design is critical to removing features that might cause illness and distraction to students.

Lack of specific pedagogy for implementation of VR as teaching tool is also an issue. Though VR can be force-fitted into existing educational paradigms with some success, researchers agree that to use it to its potential for learning there needs to be solid pedagogy associated with VR. Hu-Au and Lee (2018) caution that simply replicating face-to-face didactic experiences of learning will only result in problematic implementation. Elmqaddem (2019) points out that "it will be necessary to know how to build and deploy educational programs that are well adapted to this technology" (p. 237). Scavarelli et al. (2020) remark that the greatest challenge in using VR is "determining how best to utilize this technology to better enhance students' learning in a manner that is not merely recreating, or replacing the physical classroom" (p.17). Therefore, pedagogy needs to be developed directly for VR. Many studies on VR in education have recognised constructivism to justify the theory, which gives comprehensive guidelines for VR in education (Hu-Au & Lee, 2018, Kavanagh et al., 2017; Chen, 2009).

Conceptual Framework of the Study

Figure 3 shows the conceptual framework for the current study. The study investigates the usage of virtual reality as a teaching tool through the lens of UTeM instructors. The lecturers' viewpoints are sought on two levels: the benefits they get and the problems they face while employing virtual reality in their teaching. The benefits and problems provided are derived from a literature review. Actions for overcoming the challenges are also asked.

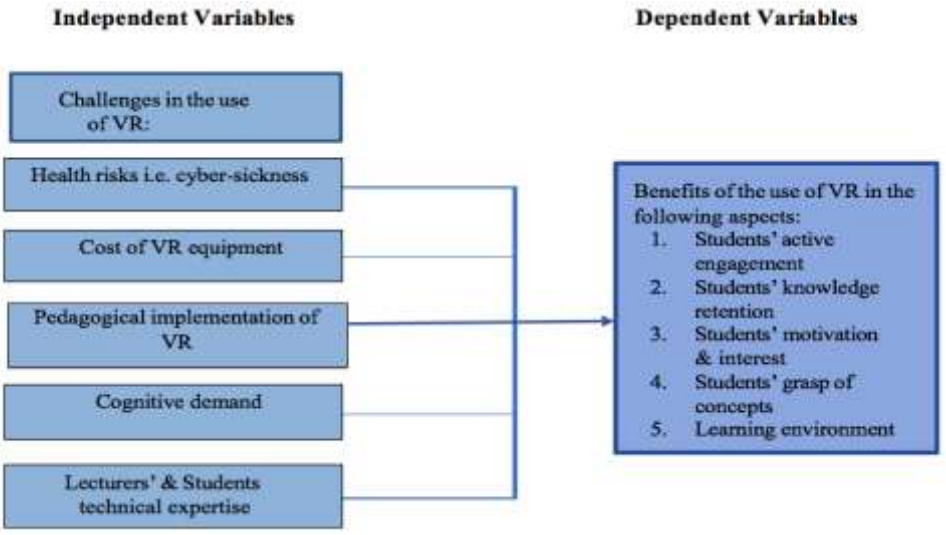


Figure 3 : Conceptual Framework of the Study

Figure 3 indicates that using VR as a teaching tool may help students learn more effectively by increasing their engagement, knowledge, and comprehension of subjects/concepts, as well as recreating a learning environment that is comparable to real-life situations. However, in order to harvest this beneficial learning, the instructors must take efforts to guarantee that the challenges/factors, i.e. health risks, cost of VR, appropriate pedagogy, cognitive demand and lecturers' and students' technical expertise, affecting the efficacy of VR as a teaching medium are adequately addressed.

RESEARCH METHODOLOGY

Introduction

A sample of four UTeM lecturers from three UTeM faculties were chosen as the participants. Selection of participants was done based on purposive sampling. The study explores UTeM instructors' viewpoints on the benefits and challenges of using Virtual Reality as a teaching strategy. As a result, lecturers who teach in the three faculties, the majority of whom focus on technical fields, are the most eligible participants for the study. These lecturers will be able to give valuable feedback on the benefits and obstacles they anticipate encountering when using VR into their teaching.

Data Collection Instrument

Interview was used as the main instrument to collect data because the researcher wants to know what instructors think about Virtual Reality as a means of instruction. These viewpoints could not be seen directly. Through interview, the interviewer has more control since the interviewer can pose particular questions in order to obtain participants' experiences. The researcher sent out invitations via email to four UTeM lecturers from the three faculties. Subsequently, four interviews were conducted. The first was a senior lecturer from Faculty of Electronic and Computer Engineering Technology, the second, with a lecturer from Faculty of Technology Management and Technopreneurship, and two lecturers from Faculty of Information and Communication Technology.

In the present study, the semi-structured nature of the interviews allows participants to offer their perspectives and explore particular issues. The questions for the interview are formulated based on the findings of previous researches on the benefits and challenges of using VR as their teaching approach.The interviews are organized into three parts: A, B, and C. Part A includes questions to gather information about the lecturers' profiles, which include their name, faculty, qualification, years of teaching at UTeM, current subject taught, and whether they have used VR before. Part B includes questions aim at getting lecturers' perspectives on the benefits of adopting VR in order to address the first research question. It begins with a question on whether they will utilise VR to teach the subject they are teaching. This question is intended to determine if the instructors support employing VR. The subsequent questions focus on the benefits of utilising VR in their teaching. Part C focuses on finding answers to the second question being investigated. The questions centre on the challenges they expect to face when utilising VR, as well as how they aim to overcome them. All interview sessions will be recorded for data transcription purposes.

Procedures for Data Collection

The data collection procedures for this study involved several key steps. First, a formal letter of approval to conduct the research was obtained. Following this, four lecturers were identified from three different faculties within the university to participate in the study. Invitations were then sent to the selected lecturers, accompanied by a briefing outlining the purpose and scope of the research. Their consent was sought for participation in the interviews, including permission to record the sessions. Finally, interview sessions were scheduled based on the availability and convenience of the participating lecturers.

The data collection procedure involved semi-structured interviews with four lecturers purposively selected from three faculties at Universiti Teknikal Malaysia Melaka (UTeM). Prior to the interviews, the participants were contacted via email and briefed on the purpose and scope of the study. Their consent to participate and permission to record the interview sessions were obtained before data collection. The interviews were guided by questions organised into three sections: participants' demographic and professional profiles, their perspectives on the benefits of virtual reality (VR) in teaching and learning, and the challenges associated with its implementation and possible strategies to address them. The semi-structured format allowed the researchers to ask follow-up questions and seek clarification to obtain a deeper understanding of participants' experiences and perspectives. The interview duration and mode of delivery should be specified to provide a clearer account of the data collection process and enhance methodological transparency.

To strengthen the trustworthiness of the findings, the researchers should explicitly describe the procedures adopted to establish credibility, dependability, and confirmability. The recorded interviews were transcribed verbatim by repeatedly listening to the audio recordings to preserve participants' original responses. The transcripts were subsequently analysed manually using thematic analysis, following the steps of familiarisation with the data, initial coding, identification of patterns and themes, and reviewing the themes against the original transcripts. The coding process involved assigning descriptive labels to meaningful phrases and sentences, grouping related codes into categories, and developing themes that reflected the participants' perspectives on the benefits and challenges of VR in teaching and learning. Where conducted, member checking may be reported as a procedure for allowing participants to verify the accuracy of their interview accounts, while peer debriefing may be described as a process of discussing the coding decisions and emerging themes with another researcher to examine potential bias and alternative interpretations. These procedures should only be reported if they were actually undertaken during the study.

Data Analysis and Interpretation

The data for the study was derived from the full transcription of the interviews with the respondents. The researcher has opted to employ a hand analysis technique. According to Creswell (2014), the hand analysis technique for qualitative data entails reading the material (transcription of interviews in this case), marking it by hand, and dividing it into two sections. Data from interviews was transcribed and then analysed. When doing transcription, the following procedures are taken: listening to the audio carefully, writing the precise words used by the participants in the recording, and replaying the tape (as many times as necessary) to retrieve the participants' exact phrases.

Once the transcriptions were finished, theme analysis was performed. Muthiah et al. (2020) step-by-step analysis is utilized as a guide. The instructions are as follows. The first step is to become familiar with the data (by extensively reviewing the interviews' transcriptions). The second step involves coding the data. Coding is marking areas of our text, generally phrases or sentences, and assigning brief labels or "codes" to explain their meaning. The third step is to examine the codes, detect patterns, and create themes. The fourth step is to ensure that our themes are helpful and accurate representations of the data by returning to the data set and comparing our themes to it. The purpose is to check that we are not missing anything, that these themes can be found in the data, and that we may make changes to improve our themes' effectiveness. If we have difficulties with our themes, we may divide them apart, combine them, reject them, or develop new ones to make it more useful and accurate.

FINDINGS AND DISCUSSION

Research Objective 1: Benefits of Utilising VR as a Teaching Tool

The respondents in general agree that using VR as a teaching tool would benefits them as instructor and their students. Four themes on the benefits emerged from the interview responses; VR promotes students' active engagement, aids in students' grasp of complicated concepts, enhances students' motivation and interest, and supports efficient instruction.

VR Promotes Students' Active Engagement

The interview findings revealed that all four respondents perceived virtual reality (VR) as a means of promoting students' active engagement by providing opportunities for practical participation beyond conventional classroom instruction. Respondent 1 highlighted the practical nature of VR, explaining that "VR exposes students to practical things and hence students are engaged in activities compared to conventional methods which focus more [on] the theoretical aspect." Similarly, Respondent 2 viewed VR as a complementary teaching approach, stating that "VR should be another option for instructors instead of just using conventional methods such as board, slides and video because VR gets students doing things when they are immerse[d] in [a] simulated world."

Respondent 3 further emphasised the role of VR in facilitating students' participation in the learning process, noting that "the inability of conventional methods of instruction to engage students in the learning process is one of their weaknesses. On the other hand, instructors can assist students in experiencing learning through the use of virtual reality technology." Respondent 4 provided a practical example of this benefit by explaining how students could learn welding through a virtual simulation before entering an actual working environment:

"One of the foundations of information transfer is the conventional instructional approach, which makes use of slides, boards, videos, and other materials. VR is an additional choice. It immerses students in a world of experiences and immersion. For example, students learn how to weld theoretically, but they can practice by immersing themselves in a virtual scenario where they practice welding; holding the instrument at a specific angle and experiencing the heater's heat. VR, then, serves as a link between practice and knowledge. For students to master the practical aspect before visiting the actual world, the VR development process must be meticulously planned and must closely mimic the real-world scenario."

Taken together, the responses suggest that the perceived contribution of VR to active engagement lies in its capacity to complement theoretical instruction with simulated practical experiences. Respondent 4's example illustrates how students may rehearse practical skills in a virtual environment before applying them in real-world settings. This finding is consistent with Leung et al. (2018) and Radianti et al. (2019), whose reviews highlighted the potential of VR to support active and experiential learning. The present findings extend this discussion by illustrating how lecturers perceive VR as an additional instructional option that enables students to participate in simulated activities rather than relying solely on conventional teaching materials. However, the quality of the learning experience also depends on the extent to which virtual scenarios accurately represent real-world tasks and are aligned with the intended learning outcomes.

VR Aids in Students' Grasp of Complicated Concepts

Three of the respondents also believed that using virtual reality (VR) could aid students in comprehending abstract concepts. Respondent 2 stated that, "…*bringing VR technology into teaching is helpful to ease students' understanding in the subject taught to them*". For instance, in the field of architecture, image processing, and video editing instructors can get their students into the simulated real world so that they gain better understanding**.** Respondent 3 also reinforced this claim. He elaborated:

*For example, students studying astronomy and architecture must comprehend the function and usage of space. A full understanding of the idea is impossible. In architecture, it may be impossible for students to visit a building in person, especially if it is located in London. However, by using virtual reality (VR) simulation, students can experience what it would be like to be in London viewing and examining the building, and these will help them better understand the theory or what the lecturers are teaching***.**

Respondent 4 explained further how VR assist in students' comprehension of subjects or concept. He said, "*VR creates an immersive environment that enables learning by doing, hence it assists students in comprehending difficult concepts since it enables them to visualise the abstract ideas in three dimensions*".

This finding indicates that using virtual reality (VR) facilitates understanding complex ideas is consistent with earlier research. Research on VR use among engineering students by Anith et al. (2024) and Soliman et al. (2021) revealed a significant improvement in the students' understanding of engineering subjects. Because they were in virtual reality (VR), immersive virtual environments might have provided them with three-dimensional visual simulations that might have been used to teach students concepts in particular situations that would be practically impossible to create using more conventional teaching methods**.**

VR Enhances Students' Motivation and Interest

Two respondents also pointed out that virtual reality (VR) creates scenarios that let students see vivid images in their minds. Immersion in the scenario and interacting with virtual objects, along with multisensory activities, boost students' interest and motivation to learn. Respondent 3 claims that "*VR makes class more enjoyable*." Many students find visual and tactile learning appealing. They are better able to relate to games since they can walk and move around in virtual reality. These boost their enthusiasm and drive to learn. Respondent 4 had a similar view point:

VR makes learning fun for these students who are primarily Gen Z. They belong to the generation that depends on technology and the internet in their daily life. A lot of these students prefer visual aids and are more motivated and attentive than those who merely listen to lectures and follow slides. They become drowsy and find the lecture dry and dull if it goes on for too long.

The current study's finding that VR increases students' motivation and interest is supported by reviews of earlier research by Leung et al. (2018) and Radiani (2019). According to their review, the usage of virtual reality (VR) has created an interesting and captivating learning environment that promotes active learning and memory retention. In a similar vein, Rahman et al.'s local study (2023), which looked into the adoption and use of virtual reality as well as its impact on learning attitudes among youth in Shah Alam, Selangor, Malaysia, found that the most significant influence on virtual learning behavior intention toward virtual reality adoption and usage was virtual reality hedonic motivation.

VR Supports Efficient Instruction

Instructors can improve their instruction and meet course learning objectives by using virtual reality (VR) as a teaching tool. Respondent 1 recognized the benefits of using virtual reality (VR) to enhance her teaching by providing students with practical experience.

She explained:

Look at the function of VR itself. VR is a three-dimensional computer simulation, as you are aware. Students can truly see how the object looks even though they are unable to see it in person. Therefore, I believe it is

more effective when educating, for instance, when you want to observe the process and the final product. Students who rely on slideshows or videos just see the process whereas with virtual reality, they experience what it would be like to deliver the product firsthand. They are able to sense the genuine circumstances.

Respondent 3 acknowledged that virtual reality is beneficial for giving students the chance to re-enact lessons:

Virtual reality facilitates effective teaching. For instance, digital VR can be used repeatedly. This suggests that students can re-run the VR simulated scenario if they are unhappy or think they missed something during their initial experience. The benefit of digital technology is that. However, under the traditional teaching method, after the lecturers have left the classroom, students are left to compensate for their lack of instruction by reading on their own.

Conversely, Respondent 4 viewed VR's worth in terms of affording him a choice to fulfil his learning aim.

With the use of virtual reality, lecturers can customize their learning objectives. Virtual reality instructors have more options for evaluating their students' learning outcomes (customization). Second, students immediately receive feedback. Students report any issues to their teachers after finishing a virtual reality experience, allowing them to quickly address them.

While the results on the other three benefits—that is, that VR encourages students' engagement, helps students grasp complex ideas, and boosts their motivation—focus on the positive effects for students, the finding that VR facilitates effective instruction comes from the respondents' perspective as instructors. It demonstrates that virtual reality (VR) is a valuable teaching tool that helps instructors accomplish their course learning objectives by allowing their students to reenact courses without their presence and, ultimately, providing them with an alternate teaching tool to meet his learning goal.

Research Objective 2: Challenges in Utilising VR and Actions to Resolve the Issues

When using virtual reality (VR) in the classroom, the authorities must address a number of issues and devise solutions to overcome the barriers. Analysis of the interview responses revealed the issues include instructors' adaptation to VR technology, students' computer and internet skills, cost for VR equipment and infrastructure, and health risk due to the use of VR. The respondents also suggest ways to resolve the issues.

Instructors' Adaptation to VR Technology

The four respondents unanimously mentioned adjusting to the new technology in responding to a question on "What challenges do lecturers face when they use VR in their teaching?" Respondents 1, 2 and 3 also claimed generation gap may be an issue to the acceptance of VR as a teaching tool. Respondent 1 said, *"May be the use of the new technology is acceptable to the younger lecturers but the older lecturers may find it difficult to adapt and object the idea of using VR in teaching".* Respondent 2 highlighted a similar issue. He argued that "being in the forties, implementing VR is a challenge as we lack knowledge about VR. So, adapting our teaching using VR with little experience would be difficult". Respondent 4, a VR practitioner, echoed the same sentiment on age gap and the importance of knowledge. He conceded that "…*they must acquire knowledge. I have attended several VR training programmes. I noticed that many of the educators find it challenging. Younger instructors typically adjust to new technology more quickly while the older instructors, particularly those 45 and above, find it hard and take longer to pick up."* Respondent 4 also mentioned another aspect that would require training and adjustment when option for VR in teaching. He explained:

Indeed, teachers must have a certain level of technological know- how because they might not be able to fully utilize virtual reality if they don't. They must possess the knowledge and abilities to use virtual reality if they plan to educate with it. Students would be lost and bewildered if their instructors were unfamiliar with virtual reality. Training is required to solve this problem. The training ought to include instruction on pedagogical techniques, software, and hardware. In order to prevent students from being disoriented when using virtual reality, teachers must make sure that the user interface is user-friendly and simple for them to utilize. In order

to exchange resources, teachers who have been utilizing VR should also offer advice to others who are still new to the technology.

Respondent 3, another lecturer who is a VR practitioner, concurred and he highlighted other fundamentals involved in implementing VR:

A lot of work is required. Knowledge comes first. Few lecturers possess the skills necessary to create virtual reality. Therefore, if they lack the knowledge, they will need to hire someone with the necessary skills to create a VR product that fits their curriculum. There will be a cost for this. Second, they must determine the equipment to design subject. They might require a good computer and a headset because 3D VR demands a lot of processing power. Third, the ability to download from the internet. Additionally, they need to know what kinds of files are appropriate for teaching, such as executive files that they can download once and use frequently or online files that use a lot of bandwidth. One more thing, we also need to allow our students to test out the VR product in order for them to understand what they would experience.

As pointed by Respondents 4 and 3, apart from knowledge and skills of operating VR equipment and using it for teaching (pedagogy), instructors need to know how to develop and create VR for lesson as well as plan instruction on pedagogical techniques.

When asked for ways to resolve the issues, all four respondents highlight the necessity for the lecturers involved to attend training or workshop to help them embrace VR as a teaching tool. Respondent 1 proposed the training be focused on VR and how to use it for teaching. Respondent 3 suggested lecturers be trained in the appropriate software and tools for their respective fields. In addition, he proposed that institutions should cover the cost of hardware for VR creation, as each subject has unique needs and criteria. Respondent 4 suggested a training on VR content development and pedagogical strategies. Additionally, instructors who have constructed virtual reality for their lessons and have expertise using it in the classroom might serve as mentors or advisors to instructors who are new to VR. Taking these steps will enable VR-based teaching and learning for students.

The findings on instructors' adaptation to the use of VR technology demonstrated the many modifications that instructors have to make in order incorporate VR in the classroom learning. These modifications include knowledge and abilities on VR, software and its technology, pedagogical techniques, and development of VR lesson and material. Wong et al. (2020) conducted a survey on the trend, acceptability, advantages, and challenges of VR in Malaysian tertiary education and found that there was high acceptance among students, but there were significant hurdles, like technological issues and inexperienced instructors. Soliman et al. (2021) also emphasized that developing VR applications is time-consuming and needs expertise in software and coding to avoid features that could distract or harm students. Pedagogy for application of VR as teaching tool is also an issue. According to Scavarelli et al. (2020), "figuring out how best to use this technology to better enhance students' learning in a manner that is not merely recreating, or replacing the physical classroom" (p.17) is the biggest challenge when it comes to VR. Consequently, teaching for VR needs to be specifically designed".

Students Computer and Internet Skills

Students Computer and Internet Skills are prerequisite for students to learn through VR. Respondent 1 maintained that students must have high level of computer and internet skills. She explained:

To learn through VR, their level of computer and internet skills should be high. But students are from diverse background; urban and rural areas and different social economic status. Some students may have more exposure and usage of computer and internet and hence have better skills whereas some coming from disadvantage background may have lower skill. So, if VR is to be implemented, lecturers will need to provide training for them to upgrade their skill and familiarise them to VR.

The other three responders, however, disagreed. Respondent 4, for instance, agreed that students need to be able to use computer, navigate the internet, and VR but to him "*students should have no trouble with these*

fundamental abilities because they are accustomed to using cell phones these days." Likewise, Respondent 2 expressed that learning via VR does not need a deep knowledge about using the technology or devices whereas Respondent 3 stressed the importance of having interest in VR. He said, "*it won't be difficult. If they have interest in VR, they will catch up quickly even if they need some supervision and are motivated*."

Respondent 4 proposed that students who are having issues should go to a workshop that introduces them to virtual reality. He himself takes the initiative to familiarize his students to VR. He said, "*I start my VR classes by giving my students a few lessons on how to utilize VR and let them go through a few VR experiences. I also offer tutorials on how to utilize and operate VR through a YouTube channel for them to view independently in order to further improve their knowledge and abilities.*"

In brief, it seems that students' computer and internet skills is not a critical issue to these lecturers except for one lecturer. However, there are possibility that some students can find VR difficult to master because of their poor computer and internet skills. In this instance, Respondent 4 offers the following actions that could be taken: progressively introducing VR to these students and providing independent access to tutorials on how to use and operate VR via a YouTube channel to help them advance their knowledge and skills.

Cost for VR Equipment and Infrastructure

The effectiveness of VR-based teaching and learning depends equally on the acquisition of VR infrastructure and technology, as well as the availability of VR facilities for teachers and students. The cost of establishing all of these standards is the main problem. The first is the price for providing students a VR set. The affordability of providing students with VR sets was questioned by Respondent 1. She said, "I don't think that most of the public universities are able to purchase the VR for all the students. We have 60 students per class. Do we have to buy 60 set of VRs?" Respondent 2 and Respondent 4 agreed that it is an issue. Respondent 2 explained that, "you see to buy an original Apple VR cost like RM2900 or we can buy an economical from China market or we don't buy full set for 60 students" while Respondent 4 commented that, "one meta quest for authentic VR costs more than one thousand. One class has between 50 – 60 students, whereas our faculty has 20 VR. What can do we meet their needs?"

Second, as mentioned by Respondent 2 and Respondent 4, in addition to the VR set, funds will be needed for PCs, headsets, console units, sharing resources, hand controllers, and gloves. Respondent 3 also listed equipment needed for developing VR lesson which include workstation, merge studio, microphone, specific sound subscription, and speaker. Third, high-speed internet, a large space for a virtual reality session where students can run or walk in accordance with the VR illustration, and observation room so that instructors can watch the students are all part of the infrastructure that have to be available. Among these facilities, they mentioned that internet is not a problem since UTeM provides quite good internet coverage and the teaching and learning are on campus. However, all respondents admitted the reality that the cost to cater for equipment and infrastructure is high while the budget is limited.

The Respondents offered a number of recommendations. One of the recommendations is for students to use their own phones. Respondent 4, who teaches Virtual Reality Technology, exemplified how this can be done:

Actually, using your own phone is a low-cost method of lowering the cost of VR. Therefore, using VR is not required. The headset is available for purchase on Shopee. Thus, we can wear the headset and use our own phone, holding it just in front of our eyes. This allows us to experience virtual reality as well. We refer to this as mobile VR 360. When you move to the left or right while wearing this headset, your tube will follow. For myself, I use mobile VR for teaching students, followed by VR headsets. Since every phone comes with a headset, mobile VR is less expensive than VR headsets. However, there is no hand control tool for mobile VR. We use our eyeballs for mobile VR. For instance, if you are supposed to pick up trash on a beach, you simply need to look at the trash for five seconds, and the trash will be picked up automatically. Therefore, if we want to use inexpensive VR, we can use mobile VR. What matters is that we achieve our educational goal.

Respondent 4 acknowledged the limitations of utilizing a mobile phone, though. Mobile phones are inappropriate for teaching tasks like welding if they do not include a hand controller.

Second recommendation is sharing the limited VR set available. Respondents 3 and 4 explained how their faculty, the Faculty of Information and Communication. Technology (FTMK), divided the students into multiple stations in order to share the already available VR set, so resolving the issue of a limited VR set. "At FTMK, we divide the 60 students among multiple stations and have them use the 20 VR we currently have," said Respondent 4. According to Respondent 3 FTMK is seeking extra funding to expand the current studio and lab (where students can experience VR that is semi-immersive).

The third recommendation is to purchase the equipment in a methodical manner. Respondent 4 provided more details about this tactic:

Our financial resources are limited and our physical space is restricted. We must be selective in order to resolve this. We can only choose the equipment that is required. At the very least use the bare minimum that still enables us to use VR. For example, purchase controller that can perform on the medium range cost but still enables students to experience VR. Achieving the teaching and learning objective is crucial. The upgrading must therefore be our top priority. We can construct a portable VR setup. So, a large lab is not necessary. Students only need to take a few steps in our virtual reality environment.

The fourth recommendation is for UTeM instructors to decide which courses require or are pertinent to virtual reality. Respondent 1 observed that "VR is appropriate when VR is compatible and relatable to the subject." Respondent 3 concurred when he stated that virtual reality is not necessary for every discipline. More accurate estimation can be achieved by selecting courses or disciplines that call for virtual reality.

Respondent 2 made the fifth recommendation, urging the administration, dean, or faculty to try to secure some funding, particularly to construct adequate and high- quality facilities for VR applications. This is a good time to do so because the government is expected to release some funding for AI and TVET in the upcoming RM14 or 15.

The results clearly show that cost is a significant barrier that may prevent UTeM from setting up the infrastructure and equipment required for VR technology. The respondents have come up with practical suggestions to minimise the cost i.e. using mobile VR 360, sharing VR set, purchasing the equipment in a methodical manner, deciding on appropriate programmes relevant to VR technologies and calling for the government to play its role in providing allocation for UTeM and the University and relevant authorities to secure fund for this purpose.

Health Risks Due to Exposure to VR technology

Exposure to VR technology may affect the students' health. All four respondents maintained that students may suffer from eye strain. Respondents 2, 3 and 4 also mentioned other common health risks; motion sickness, nausea, dizziness, physical discomfort (such as stiff neck and perspiration) and fatigue. Respondent 3 contended that "the students' vision problems are caused by flickering and strong dynamic lights, which are not representative of the real world. Additionally, the range of sight is set excessively wide, which differs from what a typical human see." Respondent 4 explained the causes further by stating that:

The mismatch between the virtual reality environment and the actual environment is the root cause of these health problems. For example, the simulated environment's light intensity differs slightly from the real one. This could result in headaches. Long- term or continuous VR use can cause eye strain, exhaustion, and physical pain. Students may react excessively due to their enjoyment of the VR environment; for instance, hitting too hard could result in bodily aches.

Respondent 4, based on his experience teaching using Virtual Reality and guiding students to develop virtual reality simulations, suggested several ways to prevent the health issues. The most important step is to make sure that the simulated and real- world environments are as closely calibrated as possible. Second, teach students to synchronizing the movements of head, eyes and objects in the virtual world to overcome motion sickness i.e. turn their head and eyes to left when the when they observe objects move to the left. Third, get feedback from students after using virtual reality scenario on the brightness and adjust the brightness

accordingly to avoid eyes strain. Finally, remind students not to overreact to simulation instead they should response appropriately to prevent bodily aches.

Respondent 4 also suggested limiting VR sessions to 5-20 minutes to alleviate physical discomforts. Students should gradually use VR for varying durations, gradually increasing the duration as they become accustomed to it. In fact, students can spend more time in VR without suffering any physical pain as they become accustomed to it.

The results show that respondents are aware of the possible health concerns of virtual reality, including headache, nausea, vomiting, dizziness, fullness, eye strain, sweating, and disorientation. These illnesses are consistent with findings from earlier research, including Chang et al. (2020) and Soliman et al. (2021). By addressing the drawbacks of VR techniques, such as reducing eye strain, implementing breaks, and lessening cybersickness, health hazards can be reduced. Motion sickness and balance problems can also be resolved with proper training and acclimatization.

CONCLUSIONS

Findings on Research

The focus of this research objective is on the benefits gained by using VR as a teaching method as perceived by the lecturers. Based on the responses from the interviews conducted, it can be concluded that Virtual reality (VR) can bring immense benefits for university teaching approaches. First, it creates immersive courses that motivate students to experiment with new things and remain engaged in what they are learning. Second, the created scenario and interaction with virtual objects as well as the use of multisensory in the activities boost students' motivation and interest in learning, Third, by helping students envision abstract ideas, the virtual environment aids in their understanding of difficult subjects/concepts. Fourth, by offering teachers a new method of teaching, enabling students to retake lesson on their own, and by providing hands-on experience, virtual reality (VR) enhances effective teaching.

This research objective focuses on two aspects: first, the challenges that lecturers may encounter while utilizing virtual reality as a teaching tool, and second, the solutions they propose to address these difficulties. Instructors face a number of obstacles when utilizing virtual reality (VR) as a teaching tool, comprising the difficulty of adapting to VR technology, students' low computer and internet skills, the high cost of purchasing VR equipment and establishing VR infrastructure, and the potential health risks of VR use. The many adjustments that instructors must make in order to integrate virtual reality (VR) into the classroom learning process include knowledge and skills related to VR, software and its technology, pedagogical approaches, and the creation of VR lessons and materials. These changes make it difficult for instructors to adjust to the use of VR technology.

The actions suggested by the lecturers demonstrate that the lecturers are proactive and hardworking instructors who are prepared to take on the problems. In terms of overcoming the instructors' difficulties to the many adjustments needed to the use of VR technologies, the steps suggested include lecturers attending training or workshops on VR as a teaching tool, VR appropriate software, VR pedagogical strategies and VR content development as well as appointing lecturers who have VR teaching and developing VR lesson experience as mentors to guide the newcomers. As to help students with low computer and internet skills to upgrade their knowledge and skills, instructors could implement VR gradually and provide independent access to tutorials on YouTube. The issue of the high cost involved to support VR implementation can be resolved by using mobile VR 360, sharing VR sets, buying equipment methodically, choosing programs and subjects that are compatible and relevant to VR technologies, and for the university to request that the government to provide funding for establishing VR equipment and infrastructure for UTeM. In terms prevention of VR health issues, measures such as calibrating simulated and real-world environments, teaching students to synchronize head, eye, and object movements, adjusting brightness based on feedback, and reminding them to react appropriately to simulations to avoid motion sickness and body aches, as well as limiting the length of VR sessions and acclimating students to VR sessions could be taken.

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REFERENCES

1. Adnan, A. H. M., Ya Shak, M. S, Karim, R. A., Tahir, M. H. M., & Shah, D. S. M. (2020). 360-Degree Videos, VR Experiences and The Application of Education 4.0 Technologies In Malaysia For Exposure And Immersion. Advance Science Technologies Engineering System Journal, 5(1) 373-381.
2. Adnan, A. H. M. (2020). From Interactive Teaching to Immersive Learning: Higher Education 4.0 Via 360-Degree Videos and Virtual Reality in Malaysia. International Conference on Technology, Engineering and Sciences 917 (2020) 012023 doi:10.1088/1757-899X/917/1/012023
3. Anith Khairunnisa Ghazali, Nor Azlina Ab, Aziz, Kamaruzaman Ab. Aziz & Neo Tse Kian. (2024). The usage of virtual reality in engineering education. Cogent Education, 11(1). https://doi.org/10.1080/2331186X.2024.2319441
4. Chang, E., Kim, H.T. & Yoo, B. (2020). Virtual Reality Sickness: A Review of Causes and Measurements. International Journal of Humanities & Computer Interaction, 36, 1658–1682.
5. Chang, S.C.; Hsu, T.; Chen, Y.N.; Morris, J. (2020). The Effects of Spherical Video- Based Virtual Reality Implementation on Students' Natural Science Learning Effectiveness. Interactive Learning. Environment, 28(7), 915-929.
6. Chen, C. J. (2009). Theoretical Bases for Using Virtual Reality in Education. Themes in Science and Technology Education, 2, 71-90.
7. Creswell, J. W. (2014). Research Design: Qualitative, Quantitative and Mixed Methods Approaches (4th ed.). Thousand Oaks, CA: Sage.
8. Elmqaddem, N. (2019). Augmented Reality and Virtual Reality In Education. Myth or Reality? International Journal of Emerging Technologies in Learning, 14(3), 234–242. https://doi.org/10.3991/ijet.v14i03.9289
9. Ghaliya Al Farsi., Azmi bin Mohd Yusof., Awanis Romli., Ragad M Tawafak., Sohail Iqbal Malik, Jasiya Jabbar. & Mohd Ezanee Bin Rusli. (2021). A Review of Virtual Reality Application In An Educational Domain. International Journal of Mobile Technologies (IJIM), 15(22), 99-109. https://doi.org/ 10.3991/ijim. v15i22.25003
10. Hamad, A. & Jia, B. (2022). How Virtual Reality Technology Has Changed Our Lives: An Overview of The Current and Potential Applications and Limitations. International Journal of Environment Resident Public Health, 19(18), 1120- 1133.
11. Hu-Au, E. & Lee, J.J. (2018). Virtual Reality in Education: A Tool for Learning In The Experience Age. International Journal in Education, 4(4), 216-226.
12. Jensen, L. & Konradsen, F. (2018). A Review of The Use of Virtual Reality Head- Mounted Displays in Education and Training. Educational Information Technology 23, 1515–1529.
13. Kaminska, D., Sapinski, S., Wiak, S., Tikk, T., Haamer, R. E., Avois, E., Helmi, A., Ogcinar, C. & Anbarjafari, G. (2019). Virtual Reality and Its Application in Education: Survey. Information, 10, 318; doi:10.3390/info10100318.
14. Kavanagh, S., Luxton-Reilly, A., Wuensche, B., & Plimmer, B. (2017). A Systematic Review of Virtual Reality in Education. Themes in Science and Technology Education, 10(2), 85–119. https://files.eric.ed.gov/fulltext/EJ1165633.pdf
15. Lazar, I. & Panisoara, I.O. (2018). Understanding the Role of Modern Technologies In Education: A Scoping Review Protocol. Psychreg J. Psychol. 2, 74–86.
16. Leung, T., Zulkernine, F. & Isah, H. (2018). The use of virtual reality in enhancing interdisciplinary research and education. Journal of Systemic, Cybernetics & Informatics, 16(6), 4-9.
17. Lin, Y., You, Y., & Zhou, Z. (2023). Application of VR in the Field of Education. Highlights in Science, Engineering and Technology, 68, 11-20.

18. Marougkas, A., Troussas, C., Krouska, C. & Sgouropoulou, C. (2023). Virtual Reality in Education: A Review Of Learning Theories, Approaches And Methodologies For The Last Decade. Electronics 2023, 12, 2832. https://doi.org/10.3390/ electronics12132832
19. Md Shamsudin, N. & Md Yunus. M. (2022). Mirror. Mirror on The Wall Are We Real In Reality? Virtual Reality Learning Application in Malaysian Education. AicQoL 2022, 10th AMER International Conference on Quality of Life, 111-117.
20. Muhanna, M.A. (2015). Virtual Reality and The CAVE: Taxonomy, Interaction Challenges And Research Directions. Journal of King Saud University-Computer and Information Sciences, 27(3): p. 344-361.
21. Muthiah, P., Naidu, R. S., Badzis, M, Mat Nayan, F., Abdul Rahim, R. & Abdul Aziz, N. (2020). Qualitative Research: Data Collection and Data Analysis Techniques (2nd Edition). UUM Press.
22. Ni, L. (2022). Learning Process Through Virtual Reality: A Theory-Based Application. Proceedings of the 2022 2nd International Conference on Modern Educational Technology and Social Sciences (ICMETSS 2022), 698-705.
23. Udeozor, C., Toyoda, R., Abegao, F.R., & Glassey, J. (2021). Perceptions of The Use of Virtual Reality Games for Chemical Engineering Education and Professional Training. Higher Education Pedagogies, 6(1), 175-194.
24. Radianti, J., Majchrzak, T.A., Fromm, J. & Wohlgenannt, I. (2019). A Systematic Review of Immersive Virtual Reality Applications for Higher Education: Design Elements, Lessons Learned, And Research Agenda. Computer. Education, 3(6), 147-162.
25. Rahman, A. A., Murad, K. & Adnan, W.H. (2023). Acceptance and Use of Virtual Reality and Its Impact Towards Learning Attitude Among Young Adults in Shah Alam, Selangor, Malaysia. Journal of Social Sciences and Humanities, 7(2), 135-155.
26. Raja, M. & Lakshmi Priya, G. (2020). Factors Affecting the Intention to Use Virtual Reality in Education. Psychology and Education, 57(9), 2014-2022.
27. Roberts, D. (2019). Higher Education Lecturers: From Passive to Active Learning Via Imagery? Active Learning in Higher Education, 20(1), 63-77.
28. Scavarelli, A., Arya, A., & Teather, R. J. (2020). Virtual reality and augmented reality in social learning spaces: A literature review. Virtual Reality, 0123456789. https://doi.org/10.1007/s10055-020-00444-8
29. Slavova, Y. & Mu, M. (2018). A comparative study of the learning outcomes and experience of VR in education. In Proceedings of the 2018 IEEE Conference on Virtual Reality and 3D User Interfaces (VR), Reutlingen,Germany, 18–22 March 2018; 685–686.
30. Soliman, M., Pesyridis, A., Dalaymani-Zad, D., Gronfula, M., & Kourmpetis, M. (2021). The Application of Virtual Reality in Engineering Education. Applied Sciences, 11(6), 2879. https://doi.org/10.3390/app11062879
31. Wittich, C.M., Agrawal, A., Cook, D.A., Halvorsen, A.J.; Mandrekar, J.N., Chaudhry, S., Dupras, D.M., Oxentenko, A.S., Beckman, T.J. (2017). E- Learning in Graduate Medical Education: Survey of Residency Program Directors. BMC Med. Educ. 17, 114.
32. Wong, Y.Y. R., Wong P. L., Wong, P.W. & Goh, C. P. (2020). The Implementation of Virtual Reality in Tertiary Education In Malaysia. (2020). International Conference on Digital Transformation and Applications (ICDXA) 2020, 1-6.
33. Yahaya, S. N., Bakar, M. H., Murad, M. A., Mohd Yusof, N. S. A., & Ghazali, A. W. (2024). Barriers That Impede the Implementation of Circular Economy Practices for the Automotive Industry: The Conceptual Framework. International Journal of Sustainable Development & Planning, 19(10).https://doi.org/10.18280/ijsdp.191038
34. Yahaya, S.N., Bakar, M.H., Jabar, J., Abdullah, M.M., Segaran, Y. (2024). Evaluating Students Acceptance of AI Chatbot To Enhance Virtual Collaborative Learning in Malaysia. International Journal of Sustainable Development and Planning, Vol. 19, No. 1, pp. 209-219. https://doi.org/10.18280/ijsdp.190119
35. Zhang, M., Zhang, Z., Chang, Y., Aziz, E.S., Esche, S., Chassapis, C. (2018). Recent Developments in Game-Based Virtual Reality Educational Laboratories Using the Microsoft Kinect. International Journal of Emergence Technology (iJET), 13, 138– 159.