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THE EFFECTIVENESS OF VIRTUAL REALITY TECHNOLOGIES TO ENHANCE LEARNING AND TRAINING EXPERIENCE: DURING THE COVID-19 PANDEMIC AND BEYOND

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ABSTRACT

During the global pandemic, we now live and work differently, forcing government decision-makers to find innovative, new ways to learn and train that will still be feasible during the pandemic. As we move slowly away from the Covid-19 shadow, upskilling and reskilling students are crucial for learning and professional development. Consequently, the pandemic has highlighted the necessity for

transforming distance learning and opened new opportunities for immersive virtual exchanges. Nowadays, virtual reality (VR) has a significant role in fighting the Covid-19 pandemic. This paper proposes the potential of integrating VR technology in learning and training perspectives as an effective strategy or approach used to complete students experiences. The purpose of this study is to develop and design a virtual environment (VE) that guides students through the educational process at high levels of performance. The focus of this study was to evaluate the effectiveness of a VR simulation for students. In this study, we have designed a VR simulation using Unity 3D software connected with the Hp reverb G2 headset. We collected data by a survey which indicates 50 samples attending a soft skills training course. The results revealed that virtual learning (V-learning) in VR is much more interactive and effective than traditional learning methods like E-learning and classrooms. This study contributes a significant role that the adoption of VR technology can be extremely beneficial to educators in helping students enhance their skills and continue the educational process in universities.

Keywords: Virtual Reality, Learning experience, Training, Immersive learning, Covid-19 pandemic

INTRODUCTION

The last 20 years have seen great significant growth in the provision of education at all levels around the world (Oluga et al., 2014). In recent years, the Covid-19 pandemic has irreversibly changed our lives in every aspect, there is no doubt that it is necessary to continuously evaluate and revise the educational landscape. The Delta variant remains the predominant in Malaysia, detected in all states and territories across Malaysia. Authorities have detected one imported case bearing the Omicron variant of concern in a traveller returning from South Africa. This includes additional Covid-19 testing as well as mandatory quarantine at the public health authority. The covid-19 pandemic poses a significant threat to higher education institutions and has significantly impacted students lives in various ways. While remote learning techniques will be different between school and higher education, the demands of skills-sector programs, such as technical, vocational education, and training require specific considerations. In this regard, Malaysia needs urgent transformations in upskilling future development or otherwise being left out in the region. Nowadays, the

use of new technology in education fields such as Extended Reality

which is on the rise, especially in 2020. Extended Reality (XR) is an umbrella term that includes each of the immersive technologies, including the ones already existing Virtual Reality (VR), Augmented Reality (AR), or Mixed Reality (MR). It can offer users the possibility to experiment with tasks in a safe and realistic environment (Alnagrat et al., 2022). The VR communication platforms support a wide range of interactivity, involving eye gaze, body/hand gestures, and speech. VR is a computer-generated simulation of a 3D environment that can be created to realistically simulate a real world. The technology of VR allows users to engage in embodied cognition and learning with their full body in a VE. The goal of VE is intended to create an immersive experience as if the user were actually in the real world (Alnagrat et al., 2021). The VR domain is extensive and ongoing in a variety of fields, including education and training (Jamah et al., 2014; Zulkifli et al., 2016). Recently, studies indicated a growing number of research examining the impact of Immersive Virtual Reality (IVR) technology on learning performance in education since the availability of low-cost head-mounted displays (HMDs). IVR experiences have the potential to be provided by VR technology. In IVR, learners can learn about concepts in unique contexts that would be difficult to achieve by traditional teaching approaches. Many VR hypotheses in education increase user engagement and motivation. On the other hand, studies indicate that VR is increasingly being utilized for training workers around the world.

There is a keen interest in using VR in education and training. One of the biggest problems and challenges faced by higher education is the requirement to update and improve skills and capabilities, including methods and strategies to achieve effective learning. Several studies and examinations have been conducted regarding the impact of VR on education and teaching (Radianti et al., 2020). Many questions regarding understanding more completely the key tenets of VR based learning and training are required. During this research, we have not found any studies that cover and measure its effectiveness in the learning process. Moreover, traditional forms of education are considered useless during outbreaks because they do not provide the full learning experience compared to VR.

In this context, one of interest is to investigate the perspective of VR on learning and training experiences during and beyond Covid-19. VR headsets are usually the focal point of VR because they are the

hardware that makes the VR experience possible.

In this study, the main objective is to investigate and evaluate student learning by employing VR technology which represent virtual semiconductor laboratory based on Virtual reality learning (V-learn) settings during the pandemic, as well as compared to e-learning and traditional classroom sessions. In this study we design a virtual learning enviroment to simulate semiconductor laboratory for student by offering working environments, complex scenarios, processes, and equipment by fully providing a deep immersion understanding of effective learning. In addition, by presenting to learner with safe space, interact more easily and effectively.

The focus of this research has emerged from the next wave of innovation and revolves around technologies that can truly enhance our limited capabilities. The contribution is to use VR technology as a solutions to confront this epidemic, as it provides immersive learning for learner to acquire new skills, raise skills, and enhancing learning experience through laboratory experiments. Hence, this technology is important for decision makers in universities to keep pace with education programs and education development.

Virtual Reality in Education

Covid-19 has disrupted education in over 150 countries and affected 1.6 billion students. As a result, many countries have implemented some form of remote learning. In light of the ongoing digital transformation represents a challenge for the education system that faces a conflict between tradition and innovation, both in the students' expectations for education, training, and educational institutions. Recently, remote learning is fast becoming a key instrument in education responses during a pandemic. VR technology has been extensively highlighted as a significant technological advancement capable of providing a creative form of education. VR has the potential to transform education by enabling learners to study in a more immersive and engaging way. The benefit of using VR technologies in education systems is expected to improve cognitive skills, motivations of students, more personalization of lessons, increased attention, and access to inaccessible sites. Studies indicate that IVR education creates a VR classroom or meeting room with engagement, which users may learn from instructors worldwide. VR seems to be able to help express a vague idea with 3D by choosing from different designs and putting that into concrete terms. For instance, the student can walk through

virtual labs in true perspective and high definition to effectively judge size, space, and dimension. Furthermore, a recent study by (Kamińska et al., 2019) found that 82 % of students thought VR learning was much more interactive than reading books or listening to lectures with overhead incorporating graphics or pictures.

Additionally, learning based on experience is widely recognized as being very important because it highlights the relationships between knowledge, skill, and experience.

Today, graduates students must have fundamental and professional knowledge. In this regard, the processes of informatization of education are accompanied by the search for new methods of organizing the educational process, focused on an individuals self-organization and self-development. A series of recent studies have indicated that VR in education makes learning more enjoyable, secure, and more interesting. According to a study conducted by the University of Warwick, students can remember study materials more in VR headsets than in textbooks, lectures, and videos. On the other hand, one of the major topics to be investigated in this field is laboratory experiments. In the virtual laboratory, students can work on complex problems in various domains and use virtual instruments to formalize process settings; instructors can monitor and diagnose the learning process. Besides that, VR learning allows students to interact with complicated environments and experiences that they would not be able to otherwise, which can be useful in various fields. For example, engineering students can conduct laboratory experiments and successfully learn engineering concepts. The use of virtual laboratories may help learners overcome the difficulties they face in traditional laboratories. Therefore, students can develop practical skills independently and at their own pace (Alnagrat et al., 2021). This study will investigate whether or not the virtual laboratory can be an effective educational tool to improve students learning during pandemic. Additionally, we examine the impact of virtual laboratories on improving student performance, increasing student capacity for learning, and increasing student motivation.

Virtual Reality in Training

The rising of computers and supporting equipment has become more powerful with the existence of a revolution in graphical fidelity, with increasingly intricate, realistic simulations and VEs (Slater, 2018). VR promises to generate realistic experiences that would

be impossible and dangerous in the real world. The VR training approach is matching to classroom training but includes the repetition of scenarios to improve practical skills. This includes cognitive load, visual attention (Bozkir et al., 2019), and training evaluation (Lang et al., 2018). This method enables employees to complete training more quickly than in traditional classrooms and e-learning environments. IVR is more effective than non-immersive learning techniques in terms of improved learning, while 3D VR is much more interesting than traditional methods. Most organizations seeking to implement VR safety training base their decisions on financial and technological considerations (Pedram et al., 2021). VR is extensively regarded as a promising tool for training emergency first responders and other safety-critical workers (Alnagrat et al., 2021). It has the unique ability to immerse learners in extreme situations that would be too hazardous or harmful to explore in traditional real-life safety training. VR technology creates interactive training scenarios to address educational needs as well as mirror complex worksites and real-life situations without worrying about outcomes. Furthermore, VR training allows trainees to have a first-person perspective of the job they will be performing. It challenges them to play through a full simulation to practice in realistic settings that mimic the real world. In theory, the benefits of VR simulations include the ability to promote students context-dependent memory in IVEs classroom. As a result, it should be possible to use a students memory of the actual world to generate new learning experiences and outcomes by utilizing an IVE toward increasing knowledge and understanding. In this context, the use of virtual reality lab as a training tool are enable students to be kept safe from the epidemic. In fact, to analyze the effectiveness of training, we will look at how much time is spent on training and how often complex scenarios are repeated. Additionally, we can determine if this type of training improves and polishes students' skills.

Learning During the Covid-19 Pandemic

Covid-19 has led to an unprecedented initiative in the use of remote learning and delivering education efficiently at scale. As an emergency response, education systems worldwide closed schools and offered remote learning options to their students. Nowadays, collaborative learning in the educational field is a growing trend in which teachers and students actively participate in the educational process. Teachers and students are physically separated during the pandemic, and collaborative learning takes place exclusively

through VR. The physical distance between teachers and students creates a potential misunderstandings space. To overcome this problem teachers should explore VR technology for ways to motivate and aggregate students in a space of trust, respect, and empathy without losing the educational objectives. VR framework is a set of functionalities and best-practice solutions for innovative training in VR that aim to make the virtual operations for every trainee easy and user-friendly. Moreover, VR training presents the information needed to teach in a structured and controlled way, including methods that can be used to assess trainee performance. The VR training provides realistic and immersive environments based on real-life work issues that answer a trainees actions. VR simulators offer the possibility of training without risk as one of their advantages. In addition, learners can avoid equipment damage by practising under controlled virtual conditions rather than risk situations in the workplace. Nowadays, digital technology opens a new learning space, where students are immersed in various technological learning platforms, equipment, and applications. Recently, the technology market is one of the winners of the Covid-19. During that time, virtual headset sales growth of the user base was noticed. VR became a popular form of learning during a period of quarantine and isolation. Several universities have even been predicted to be replaced if there are travel bans related to the pandemic (Sarkady et al., 2021). VR can bridge the gap between online learning and traditional face-to-face training. VR is one of the most important factors that will change education in the future. This is possible as internet connections become more widely available and computer processing power improves. Therefore, it can be applied to other areas, such as educational development or training. As a result, VR practical applications are becoming more popular, and it is currently being used in workplace training and a variety of other areas. Uniquely, it allows learners to practice in various industry scenarios, which helps them to be more prepared for similar situations in the workplace. During training, being mindful of wearing a face mask and keeping a distance of 1.5 meters have important implications for safety policies. This distance is a common recommendation to reduce virus transmission (Savage et al., 2021). VR has opened up many opportunities in education over the past few years. By offering distance learning courses such as collaborative skills and virtual labs where teams can work together. In this study, we will focus on making the virtual laboratory based on health standards that help reduce the number of infections, maintain social distance, and use masks and

sterilizers.

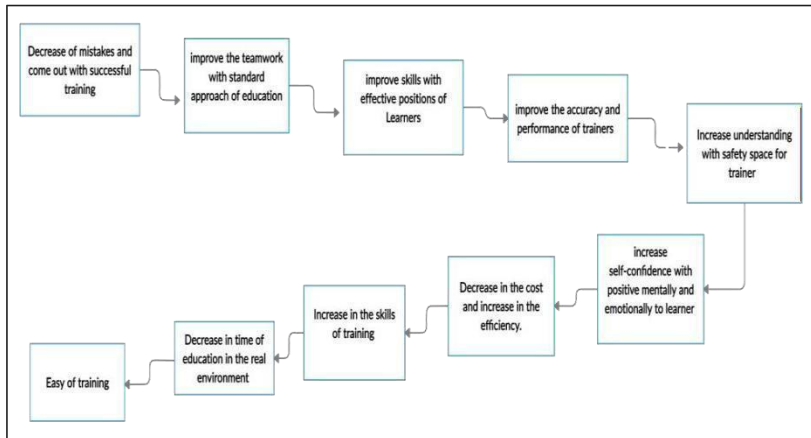
METHODOLOGY

Research Design

The pandemic has caused people to adapt and shift the way of learning, with blended learning becoming the standard. This learning method is likely to continue after the pandemic, as it provides the learner with a more dynamic learning approach. On the other hand, one of the most fundamental difficulties the students have encountered is a lack of interaction. This is because being isolated the whole day at home does not provide a lot of stimulation. The working process of VR in pandemics has already led to distance and e-learning. They became prevalent almost overnight, with VR having the ability to enhance and tweak e-learning by offering unique educational experiences from one's home (Maheshwari & Maheshwari, 2020). Nowadays, research in VR and wearable devices challenges the implementation of laboratory experiments due to health concerns. VR can enable interaction with things that are distant and dangerous. In short, VR technology provides learners with hands-on experience of previously inaccessible things to hands. VR -based courses involve several logistical challenges for learners. While utilizing VR technology in higher education, guidelines for best practices in learning and teaching are selected to help students provide safe and engaging immersive experiences. The limitations on laboratory access encountered during COVID-19 call for the development of reliable remote data collection techniques, especially for research disciplines such as VR that involve a great deal of laboratory work. The demand for conducting unsupervised experiments has grown even more during the Covid-19 pandemic. There are a variety of possibilities in the concept and process of VR that are helpful to mitigate the Covid-19 effects. This makes it increasingly applied in other areas, such as developing educational applications. As shown in Figure 1, we also have a development cycle of design which represents the regulation of VR learning environments during Covid-19.

Figure 1

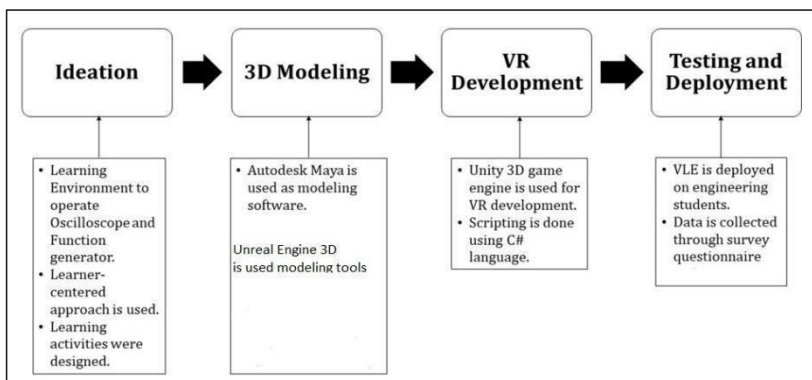
Key Advantages of VR Training Approach to Fighting Covid-19 Pandemic



In the following section, a VR framework is presented, which is used to develop a learning environment for encouraging students to utilize laboratory experiments. In figure 2 shows the development cycle for a VR-learning environment.

Figure 2

Development Recess of VR-based Learning Environment



Ideation

VLE is designed using the learner-centered approach to help students in handling with lab equipment. Beyond focusing entirely on learners, the learner-centered approach places more responsibility on them, reducing the role of instructors (García-Cabrero et al., 2018). The VLE's technological design is supported by its instructional design, which keeps learners in control of their learning. This process focuses

on implementing learning activities related to laboratory hardware in order to better develop the learning environment, because these tasks are critical in achieving the learning objectives of the laboratory. Learning with a VLE allows students to interact with 3D models rather than actual ones, thus giving them confidence to handle the hardware.

3D Modeling

In this phase, it is important to survey the actual laboratory equipment before beginning the modeling process. Multiple perspectives of the equipment were captured for reference. As part of the development process, reference images were used to check the accuracy and precision of 3D models. The VR equipment and function generator 3D models were created using Autodesk Maya and Unreal 3D modeling software.

VR Development

The VLE was designed using the Unity 3D game engine. In Unity 3D, the 3D models of laboratory equipment are imported as game objects. In the Unity editor, control scripts are written using C#. Users can generate different signals and set the parameters of the 3D models using the interactive 3D models. Users can also interact with the lab equipment models using the interactive 3D models by wearing HMD Hp reverb G2 headset which is connnedcted to gaming desktop computer using cable.

Statistical Techniques and Sample

The reliability analysis and descriptive statistics were utilized to evaluate the users. The analyses were carried out using the SPSS version 28 software for Windows 10 operating system. The survey covered usefulness (Davis, 1993), ease of use (Davis, 1989), functionality, efficacy, satisfaction, outcomes, and future usage (Hudson et al., 2019; Lvov & Popova, 2019; Merchant et al., 2014; Yilei Huang et al., 2019). The user's performance level can be measured by usefulness and ease of use, VR effectiveness and functionality of user's perception (Marsh, 1999), and satisfaction contents (Kim & Ko, 2019). In this paper we have used questionnaires which is mostly used in conducting quantitative research, where the researcher wants to profile the sample in terms of numbers. In fact, questionnaires are generally considered to be high in reliability. Admittedly, the survey is probably the most commonly

used in research because it is possible to ask a uniform set of questions. Undoubtedly, Questionnaires and rating scales because are commonly utilised to measure qualitative variables, such as usefulness, ease of use, functionality, efficacy, satisfaction, outcomes, and future of usage. Generally, the study was conducted among the 50 engineering students drawn from Universiti Malaysia Perlis (UniMAP) at Electronic Engineering Technology (FTKEN) as shown in table 1.

Particularly, the sample of participants consists about 27 males and 23 females. Clearly, we classified the sample based on academic degrees, 35 are Bachelor's students, and 5 are Master's students. Consequently, the sample was classified in terms of age factors as follows, 30 respondents were between 21-26 years, 10 were between 27-31 years, 5 were between 32-36 years, 4 were between 37-40, and 1 were over 40 years.

Table1

Details of participants

Gender		Number of students	
		Bachelor's	Master's
Male	27	18	3
Female	23	17	2
Total	50	35	5

Equipment

The hardware equipment used in this study was as follows VR a Windows 10 Pro operating system and system type was 64-bit, the equipment consisted of high-end gaming computers that met the performance requirements of the head-mounted display (HMD), and it included a desktop computer, the proposed method runs on a computer equipped with a quad-core Intel with an Intel(R) Core (TM) i7-10700 CPU at 2.90 GHz, 16 GB RAM, and NVIDIA GeForce RTX 2060 Super graphics with 16 GB GPU, a USB port 3.0, TP-Link UB400 Wireless Bluetooth 4.0 Nano USB Adapter for controllers. To enable tethering of HMD headset involves connecting to a high-performance computer via a cable. since it provides better performance.

RESULTS

Training Time in VR Courses

The construction of creating virtual worlds is a difficult task. Therefore, it is necessary to adopt a training method that enables the software team to focus on specific skills to understand the complete experience. There are several key advantages of the VR training approach to fighting the Covid-19 pandemic, as shown in figure 1. VR's significance in soft skills training may help students meet their workforce's virtual learning demands. VR classes could support students learning up to four times rapidly. However, VR may encourage employees to spend approximately 1% of performance in seven days of training and education. Thus, researchers have made sure that time is being used productively.

Measurement

A total of three test groups were identified and divided based on training classification. Hence, each group was asked to attend either a classroom, e-learning, or a virtual learning session as shown in figure 3. Firstly, classroom training takes about 2 hours including the first thirty minutes of class, instructors encouraged participants to adopt inclusive leadership behaviours. There was an hour of class dedicated to identifying inclusive and non-inclusive behaviours. The goal was for learners to self-identify areas where they could improve their inclusive leadership behaviour. Secondly, E-learn through the online learning module, learners could complete the course at any time using portable devices such as smartphones and laptops. The participants took a 45-minute training course that included the same activities, videos, and reflections as the classroom version. It was difficult to control learner attention with the e-learning training. As a result, learners easily became distracted and focused elsewhere during the training session. The learners asked some questions at the end of the classroom and e-learn course experiences. Thirdly, V-learn participants took probably take around 30 minutes of training via VR experience produced by wearing a VR head-mounted display (HMD) over a students eyes, substituting their actual surroundings with a digitally generated visual, providing the learner feeling in a new environment. Consequently, VR learners were up to four times faster than in the classroom and 1.5 times faster than in e-learning. Employees trained using VR completed training faster. We found it is still three times faster than a classroom and 1.15x faster than e-learn. Significantly, the learner is more likely to learn virtually with full enthusiasm for their work, and achieve a high success rate.

Figure 3

The Percentage Level of VR Expected Time to Complete Soft Training Skills

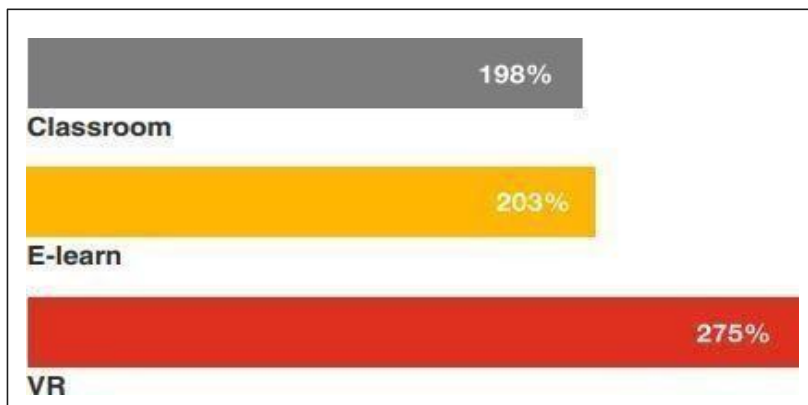


Virtual Reality Learners Confident

Undoubtedly, confidence is a significant factor in success while learning soft skills. In this regard, users often wish to practice virtually and handle difficult situations safely. Conversely, VR-based training builds high confidence and improves the opportunity for the learner since it allows them to practice in an immersive and low-stress environment. In essence, it is essential since confidence is a fundamental driver of success when it comes to soft skills. In fact, the ability to believe in themselves and have confidence helps learners connect with others and feel more satisfied after training sessions. As a consequence, v-learners reported students were close to 275% more confident in acting what they learned afterwards. The percentage was 40% in-classroom training, while e-learning training increased by over 35% as shown in figure 4. Thus, VR learners were almost two and a half times more confident in VR training and nearly three times more confident in acting on diversity and inclusion issues after the VR training.

Figure 4

The Percentage Level of Improvement in Confidence Acting After Training



Comfortable Learning Environment

The learning environment in VR is comfortable where learners can repeat experiences to improve soft skills outcomes. Therefore, 24% of learners opted to retake one or more of the learning modules. Based on the results of the survey, 97% of v-learners agreed that practice time was useful. As a result, in terms of using the abilities students learned during training, VR learners were 40% more confidence than a classroom and 35% more confident than e-learners. On the other hand, improving attention has significant benefits in terms of students understanding.

The participants in V-learn were up to four times less distracted during training than those who trained in E-learning, as well as 1.5 times less distracted than those who trained in a traditional classroom. The additional advantage of using V-learn is building confidence during learning. We describe the results of VR learners, which show 50% significantly higher confidence than online learners and classroom learners. From the results, it is clear that confidence is the key to success in soft skills. In contrast, confidence makes it possible to create a sense of employee satisfaction, which helps employees retain their jobs, reduce mistakes, as well as improve quality. This gives clearly better results than the traditional classroom.

Nowadays, students are much less distracted when using e-learn or classroom. This seems to be a common problem in the education system. In recent times, VR students are more focused during V-learn courses. This has been widely adopted in the field of education especially at the time of the pandemic. Since simulation models and

immersive experiences dominate the participant's eyes and attention in a VR headset, there are no distractions or multitasking options.

The results of the experiment found clear support for the student who had received VR training were up to four times more concentrated during training than those who had received e-learning training. Our results cast a new light on the efficacy of soft skills training as shown in Table 2. From these results, it is clear that the V-learn were 1.5 times more focused than those who had received classroom courses. However, it performs well, giving good results are achieved when learners are immersed in the VR experience. This delivers significantly better results due to retaining information and achieving higher outcomes.

Table2

The Efficacy Percentage of Soft Skills Training

Flow of tasks	Type of learning		
	Classroom	E-Learning	V-learn
Multitask or distracted time during the experience	0.78	1.93	0.48
Estimated time by minutes to get back on task	1.00	2.63	0.48

User Satisfaction

Humans are designed to learn by doing (Oluga et al., 2014). To guarantee learners' most intuitive training experiences, several users test interactive VR tools to ensure that trainees can practice procedures and have a seamless, true-to-life experience. In addition, focusing on learning after each high-fidelity training scenario aid learners in receiving immediate feedback. Training is designed to help students practice the skills to evaluate their performance, where they need to do their training efficiently and safely. A unique feature of VR training is a tutorial to ensure that they are maximally user-friendly for people without much digital experience. The best part is that VR training helps engineers understand their complex work processes, make correct decisions, and operate safely. The immersive experiences generate a powerful sense of realism when replicating a working environment. This is because the environment must mirror various actual scenarios, even possibly hazardous ones, to help students achieve a high level of Environment, Health, and Safety (EHS) performance. Additionally,

high-end VR training provides simulated conditions in a safe and realistic virtual real-life environment. The users would enjoy v-learn more than traditional learning methods. The result of user evaluation in terms of ease of use was (4.290), usefulness (4.480), functionality and effectiveness (4.100), satisfaction (4.370), and future usage (4.530). The value of VR-based training evaluation factors showed that great interest (0.862) was the highest, followed by reality (0.841), availability (4.575), immersion (4.180), understanding (4.574), and safety (4.414). As for the importance of the equipment effects, reality (0.798) was the highest value. The Cronbach alpha values were calculated to determine the inter-item reliability which assesses the degree of internal consistency between multiple measurements of a dimension. As all dimensions have values of greater than 0.7, those that meet all suggested internal reliability criteria (Nunnally, 1994). Throughout this study, self-report measures were based on a 5-point Likert scale. V-learning was preferred by all VR participants over more traditional learning methods. Among participants who had previously completed a classroom or e-learning course and then were offered the v-learn course, 91% of them chose the v-learn course.

DISCUSSION

The benefit of using the VR experience is expected to generate a powerful sense of realism and authentic reproduction of working environments. This is important because it is crucial to ensure that each trainee gains a realistic insight into every task and operation. The use of VR training should contribute to improved learning outcomes by aligning the unique capabilities of immersive technology (Makransky & Petersen, 2021). There is a huge amount of evidence that VR training is much more engaging than traditional training techniques (e.g., (Baceviciute et al., 2022; Parong & Mayer, 2018). We have shown that VR training aims to provide trainees with all information they need to perform well in a fully IVE. Therefore, a VR system should provide sufficient experience to be like real-world training (Monteiro et al., 2021). Nevertheless, we found V-learning is expected to be a major contributor to a new era of the workplace, education, and training by providing a cost-effective, efficient experience, and immersive, for soft skill training. A study found that V-learners were up to four times more focused than e-learners. They trained up four times faster than in a classroom and 1.5 times faster than via e-learning. At scale, v-learn is predicted to be more cost-efficient than classroom or e-learning. Conceptually, the theory of exploratory learning in VR constructionism describes how students learn unique skills and

gain creative knowledge. Fundamentally, constructivist educational approaches indicate that the students may learn and gain knowledge through experience. Overall, our results demonstrate a strong effect of users who received soft skill training with VR were more confident in acting on what they learned than those who received other types of training. The author believes that interactions in IVR training must be intuitive and mirror real actions and processes. Additionally, VR training should provide a realistic environment where trainees can learn to use sophisticated tools and deal with unexpected scenarios. Best of all, the system has been created to work in a standard room. Thus, the only special equipment that the university needs are the HP Reverb G2 headset, controllers, and appropriate space to put them in.

CONCLUSION

VR is a new medium that should be considered when training specific skills. This multimodal approach is the way of the future. VR is ideal for practising what you learn in a safe, dynamic environment, while e-learning is excellent for learning how to use software for a learning burst. The classroom format is ideal for collaborating and discussing a topic. Combining both gives your employees a leading perspective. This new modality, training and education will likely undergo a paradigm shift. The benefits of VR are undeniable when used correctly. Our research discovered that VR training is predicted to be more cost-effective than classroom and e-learning at scale when given to many people. It can be concluded that V-learn became 52% more cost-effective than classroom and e-learning. Therefore, remote collaboration systems have become increasingly important today, especially when physical distancing is advised. While VR holds a leading opportunity for improving workplace skills by providing scalable hands-on practice and feedback in a realistic and accessible on-the-job environment. VR technology has shown an increased and significant interest in educational research due to its ability to simulate real-world settings via VEs. In addition, VR in industries increased usage of experience is instructive training by allowing users to immerse themselves in a highly virtual world. In conclusion, Virtual Reality Environments (VREs) seems to improve the efficiency of employee performed activities, safety, and minimize costs. VR was previously costly, complex, and challenging to implement in larger teams. Nowadays, VR headset ecosystem costs from \$399 to \$1,000, these units can be controlled like smartphones and used to provide training several times. It can be used anywhere and at any time. Researchers have discussed the

effectiveness of VR to help learn and train, and the results are similar whether it was conducted before or after

Covid-19. However, this study still has some contribution due to the differences in sample, method, setting, instrument, and demographics of its participants. The future work will be in developing the virtual laboratory, increasing the number of trainees, and providing the possibility of cooperation between students in the virtual environment, which helps to cooperate in conducting experiments and complex operations that require more than one student in order to complete the experiments successfully.

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AUTHOR CONTRIBUTIONS

All authors contributed to the study conception and design. Material preparation, data collection, and analysis were performed by all authors

CONFLICT OF INTEREST

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ETHICS STATEMENT

Informed consent was obtained from all individual participants included in the study.

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