Tertiary Educators' Awareness of and Readiness to use Virtual Reality (VR) in Remote Online Learning

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Abstract: COVID-19 pandemic has transformed the conventional education landscape to online remote learning. However, this transition has brought about certain challenges such as low levels of student engagement and motivation, which raises the question of whether students are actually learning. Using Virtual Reality (VR) in teaching and learning (T&L) could increase engagement as it provides interactive experience that necessitates students' online presence. Literature shows students are aware of VR benefits, yet not many tertiary educators are using VR. Thus, this study aims to investigate Malaysian tertiary educators' awareness of VR and readiness to explore its potential in remote online T&L through a questionnaire survey adapted from previous studies that applied the Technology Acceptance Model (TAM) as their theoretical framework. Of 26 respondents, only 4 had VR experience in the classroom. While others lacked VR experience, their perceptions were positive, and they were aware of the challenges of using VR. It can be concluded these challenges are partly the reasons why VR is under-utilised. The findings implicate the need to train and familiarise tertiary educators in the use of VR for the continuous intention to use VR. It is believed that when more educators have more intimate knowledge of VR, the more students will benefit regardless if the classes are remote online or otherwise.

Keywords: Virtual reality, Tertiary educators, Remote online learning, Technology Acceptance Model (TAM)

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Introduction

The COVID-19 pandemic has necessitated the adoption of remote online learning (ROL). Due to lockdowns disrupting once-thriving classroom environments, education providers were forced to rapidly deploy online learning technologies to facilitate engagement with learners remotely (Turnbull et al., 2021). Remote learning is not to be confused with online learning. Online learning refers to learning that is facilitated online, but not necessarily remotely as both teacher and students can be in the same classroom while working through lessons (Roe, 2020). Remote learning refers to when learning takes place in distanced locations without the need for physical presence in a traditional classroom setting. In remote learning, technology is utilised to disseminate information such as through video conferencing, and discussion boards (Roe, 2020). ROL can take various forms, including live virtual classes conducted in real-time through video conferencing platforms, pre-recorded lectures or instructional videos that students can access at their convenience, online discussion forums or chat groups for collaboration and communication, and digital platforms or learning management systems where course materials, assignments, and assessments are shared and readily available for learners.

The COVID-19 pandemic has significantly accelerated the adoption and prominence of ROL, as it provides a flexible and accessible alternative to in-person education when physical attendance is not feasible or safe. As a result, educators have transitioned from the traditional face-to-face, synchronous learning approach to remote online teaching, where interactions with students occur virtually through online meeting platforms like Zoom, Microsoft Teams, or Webex. This shift has posed challenges as students grapple with learning in isolation, facing internet connectivity issues, family disruptions, and sharing devices with siblings (Song & Lim, 2022; Kruszewska et al., 2022). Furthermore, not only do educators have had to adapt to new platforms and systems, they also have had to contend with issues such as poor learner engagement and motivation (Capone & Lipore, 2022; Aldossari & Altalhab, 2022). Joshi et al. (2020) reported findings from a survey administered in 2 rounds on agriculture and natural resource science students and instructors in a US-based university that students consider the lack of hands-on experience and poor instructions as the most important weaknesses of online learning. This is because in online classes, students often attend with their cameras turned off, making it difficult for educators to gauge their level of participation.

Furthermore, in the new normal shaped by the pandemic, it has been observed that ROL is practical as many universities now embrace substitute blended learning (Shi et al., 2021). Different from blended learning in

which classrooms are flipped, ROL allowing students to cover specific materials beforehand and utilize class time for practice and discussions, in substitute blended learning, students take charge of their own learning for a designated period. Educators would provide carefully crafted and curated learning materials and assessments for students to access and complete during that period. Presently, the learning process is a one-way approach, lacking interactive elements. However, this signifies that ROL will endure in teaching and learning due to its convenience and flexibility. This follows that the issue of learner engagement will also persist as engaging and maintaining student engagement is a primary goal for educators. According to Tawafak et al. (2020), it is important to measure the academic performance for students through the improvement of using technology integration as a support for teaching methods to help students in their studies especially in online learning. The challenge of remote learning and online learning is ensuring learner engagement during online classes.

Virtual Reality (VR) in Teaching and Learning (T&L)

A potential solution to foster learner engagement for ROL is the integration of Virtual Reality (VR) in Teaching and Learning (T&L) practices. VR can be defined as a simulated interactive environment created by a three-dimensional computer-generated graphics system, complemented by various interface devices (Guttentag, 2010; Brey, 2014). This technology offers users an immersive experience, allowing them to explore and interact with artificial, digital worlds (Shen et al., 2020). A VR system typically provides real-time, viewer-centered head-tracking perspective, a wide field of view, interactive controls, and a binocular display (Doerner et al., 2022; Cruz-Neira et al., 1993). Popular examples of VR include games like Resident Evil 7 (PlayStation) (Pallavicini et al., 2018) and Microsoft Flight Simulator (Trinon, 2019). Unlike Augmented Reality (AR), which enhances the physical environment using tools like mobile phones e.g., to chase after a Pokémon in the streets, VR immerses users in a completely virtual world, effectively blocking out their real surroundings. This raises the question, “Is it more effective to rely on predominantly one-way learning approaches, or should students be immersed together in a virtual world for their learning experience?” Findings from recent studies indicate that students are interested in the use of this technology (Shen et al., 2018) and the idea that immersive learning through a virtual environment presents a compelling alternative.

Since VR's existence in the 1960s to its application in T&L in the late 90s and early 2000s, educators and researchers began recognizing the potential of VR as a tool to enhance learning experiences and improve engagement. Initially, VR was primarily utilized in specialized fields such as medical training and military simulations due to its cost and complexity. Over time, VR technology has become more advanced and more accessible. To date, its use in T&L has also expanded to various educational settings and disciplines such as science, engineering, art, history, offering students immersive and interactive experiences that can deepen their understanding and engagement with the subject matter. Literature reveals VR increases learner engagement, motivation and learning outcomes as VR makes learning not only an interactive experience that requires students’ online presence (Shen et al. 2018), but students also find it more interesting and fun to learn as the emphasis is on the teaching materials (Ahmad et al., 2019). Literature has also shown that students were open enough to using VR to the extent that they were willing to pay extra tuition fees (Wong et al., 2020).

However, despite all its potential and the interest students have shown, the widespread adoption of VR in T&L is still relatively limited, and it remains largely under-utilised by educators in the classroom (Wong et al., 2020). Wong et al. (2020) further add that VR is still not a trend in local tertiary institutions as educators are still reluctant in adopting the technology mainly due to lack of technical skills. Similarly, according to Md Shamsudin and Abdul Majid (2019: p.19), "current pedagogical methods and tools at the tertiary level are unable to provide students with realistic and practical usage of virtual reality due to incompetence and lack of IT skills among educators". To resolve that, Halili (2019) suggested for Malaysian educators to be given training to enhance their IT skills and be exposed to more VR applications.

Md Shamsudin and Abdul Majid (2019) also claimed that universities lack the needed facilities to prepare students and educators for VR in the teaching and learning process. It was argued that for the courses to apply mobile VR applications effectively, a framework should be developed and proposed to assist educators and students in higher education institutions. No doubt that the learning process will be more engaging and motivating for the learners using VR, but VR applications apparently bring a lot of challenges in terms of financial support from the learning institutions, and the readiness of the educators to apply VR in their classroom (Adnan, 2020; Md Shamsudin & Abdul Majid, 2019).

Furthermore, many VR applications require students to physically be in a lab or attached to Head Mounted Devices (HMD) which may not be possible in ROL. As such, how will educators address this challenge as the VR technology that educators can use in ROL would be limited. As such, Rafidi (2020) stated that it is high time for Malaysian educators to embrace 21st learning such as VR as it is one of the technology pillars of Industry Revolution 4.0. While the global lockdown is perceived negatively as it has disrupted the entire education system and student learning, it should be seen as a catalyst to spur 21st century learning and VR is among the technological pillars of the Industrial Revolution 4.0 (Rafidi, 2020).

Virtual Reality (VR) for Tertiary Education

The Ministry of Higher Education (MOHE)'s Fourth Industrial Revolution (IR4.0) Action Plan involves four strategies such as Strengthening Education Governance System towards IR4.0; Enhancing Education 4.0 Ecosystem; Developing Highly Skilled and Knowledgeable Talent for IR4.0; and Enhancing Research and Innovation Towards IR4.0 (Raman & Rathakrishnan, 2019). Therefore, Malaysian higher education institutions should be prepared to gear their educators to cater to the demand of the IR4.0 policy by providing them with appropriate knowledge, skills and values. The real problem faced by education in universities is a need for several applications in learning and education and tool technologies to improve their outputs and improve on teacher-student prospects (Tawafak et al., 2019). Our research has found that, to date, there is a lack of studies on Malaysian tertiary educators' awareness and readiness on using VR applications for remote online teaching. While VR is promising for engaging learners in ROL, the question is whether educators are willing to adopt VR. Therefore, this study explored Malaysian tertiary educators' awareness of VR. This study also aimed to provide insight to the educators' readiness to explore VR in remote online T&L.

Technology Acceptance Model (TAM)

Technology Acceptance Model (TAM) is a theoretical framework that aims to explain the process of user adoption and acceptance of new technologies. This framework studies individuals' attitudes and intentions related to the use of a particular technology and how these factors influence their actual usage behavior. TAM consists of two significant components. Figure 1 illustrates TAM proposed by Davis (1989).

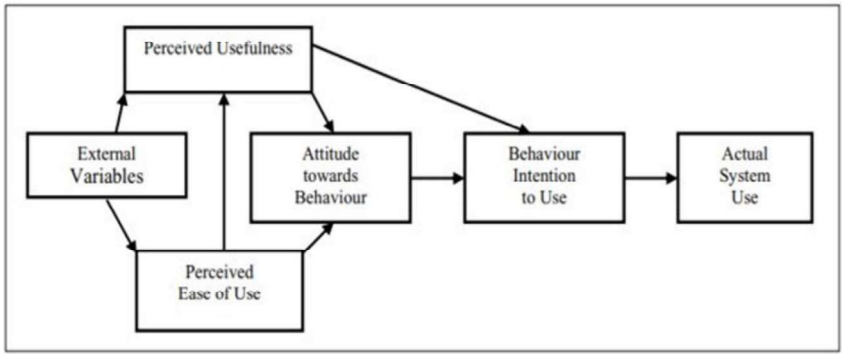

Figure 1. Technology Acceptance Model (TAM) by Davis (1989)

Perceived Usefulness (PU) is one of the primary components of TAM that refers to how users view a specific technology's ability to simplify tasks or enhance job performance. In other words, if users perceive a technology as valuable, they have more tendencies to accept and adopt it. Several research conducted in the past from various fields have proven this claim (Erjavec & Manfreda, 2022; Zhong et al., 2021). This study utilizes the concept of PU to investigate how tertiary educators perceive the usefulness of VR technology and its potential benefits in the context of ROL. These benefits encompass improved student engagement, enhanced comprehension and retention of complex concepts, and the ability to simulate real-world scenarios. Another essential component of the TAM is Perceived Ease of Use (PEOU), which focuses on users' perceptions of the effort needed to comprehend and utilize a technology. If users perceive a technology as user-friendly, they are more inclined to accept and adopt it (Al-Maroof et al., 2020; Yang & Shih, 2020). This might involve considering factors such as compatibility with existing educational technologies, the availability of support and training, and the perceived effort needed to implement VR into ROL settings. As shown in Figure 1, these two components directly impact users' attitudes and behavioral intentions towards technology usage. Attitude towards using a technology is influenced by both PU and PEOU. Consequently, the intention to use technology is influenced by the attitude towards it.

Researchers have expanded upon the TAM model by introducing additional factors like subjective norms and facilitating conditions. These additions enhance our understanding of technology acceptance. In this study, Section B of the questionnaire addresses educators' awareness and preparedness through seven qualitative questions. Awareness encompasses both perceived usefulness and perceived ease of use, which may or may not impact their readiness. Here, readiness refers to the behavioral intention to utilize VR in ROL. The TAM model

has been extensively applied and expanded in various research settings to examine and predict individuals' acceptance and adoption of new technologies. It offers valuable insights for technology designers, marketers, and researchers to evaluate and enhance user acceptance.

Method

Research Design

This study utilized a qualitative research design, chosen for its suitability in obtaining insights into the awareness and readiness of Malaysian tertiary educators regarding the integration of VR in ROL (Creswell & Clark, 2017). To accomplish this, the subsequent section will offer a comprehensive account of the employed research instrument, participant demographics, and the analysis conducted for this study.

Research Instrument

To explore educators' awareness and readiness in utilizing VR within ROL, this study adopted the TAM framework proposed by Davis (1989). A questionnaire consisting of two parts was distributed to participants through Google Form over a span of 4 weeks. Part A comprised demographic information such as age, gender, work experience and other relevant details. The demographic information is useful to provide context and background information on the participants. Part B included qualitative open-ended questions which were designed to gather insights into the participants' awareness and readiness when it came to using VR in ROL. Table 1 below shows the questions that were asked regarding their awareness of VR in Part B of the questionnaire.

Table 1. Part B Awareness of VR in ROL

Question Number	Description
Q1	Do you have any knowledge of using VR? If yes, to what extent?
Q2	Have you ever used VR in teaching?
Q3	List the courses you have used VR for and the VR application you used the purpose and duration (for example: YouTube VR and VR Headset - only 1 lesson about 2 hours during class time OR asynchronous)
Q4	How long did you use VR for? (For example: 2 semesters)
Q5	Do you think students would enjoy learning/ be engaged if VR is used for remote online learning? Why?
Q6	Would you be interested in using VR for teaching? Why?
Q7	What issues do you foresee if VR is used for remote online learning?

Part B's qualitative data provide insight into the educators' awareness and readiness for using VR technology in their classrooms. For clearer understanding, questions 1-5 focus on exploring their awareness, while questions 6

and 7 concern their readiness. These questions were aided by TAM theory. After obtaining both demographic and questionnaire data, thematic analysis was employed to uncover the awareness and readiness of the tertiary educators regarding the usage of VR for ROL.

Participants

The target participants of this study were tertiary educators from higher education institutions in Malaysia, with the majority of them from Universiti Malaysia Pahang (UMP), International Islamic University Malaysia (IIUM), and Universiti Teknologi MARA (UiTM) initially. Due to a poor response rate, the selection was extended to include educators from other institutions. This resulted in a total of 26 participants, which are described in Figure 2 below. The demographic data comprises of factors such as age, gender, teaching experience, and institution affiliation.

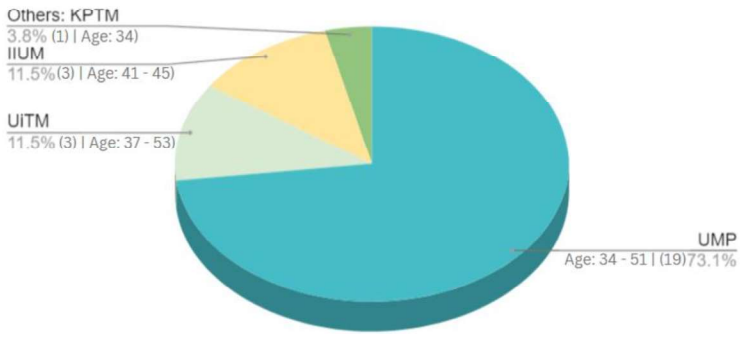

Figure 2. Respondents' demographic information

Figure 2 reveals that 26 respondents participated in the study, 19 of which were from UMP aged between 34 and 51. Three were from UiTM aged between 37 and 53, followed by 3 from IIUM aged between 41 and 45. Finally, there was one respondent from Kolej Poly-Tech MARA (KPTM) aged 34.

Results and Discussion

In Part B of the questionnaire, Malaysian tertiary educators' awareness and readiness to use VR for ROL was explored through 7 open-ended questions that were grounded in TAM (Davis, 1989). This section will discuss the findings on educators' VR awareness first. Subsequently, the educators' readiness to use VR for teaching in remote online classes is also examined.

Malaysian Tertiary Educators' Awareness of VR

In Part B of the open-ended questions, Questions 1 (Q1) to 5 (Q5) pertained to participants' awareness of VR. For improved comprehension, the findings for Questions 1 to 4 will be presented first. Of the 26 respondents, only seven acknowledged being knowledgeable when it comes to using VR, as depicted in Figure 3. Two of the seven respondents indicated their knowledge level to be "average" (R5) and "only a little" (R12).

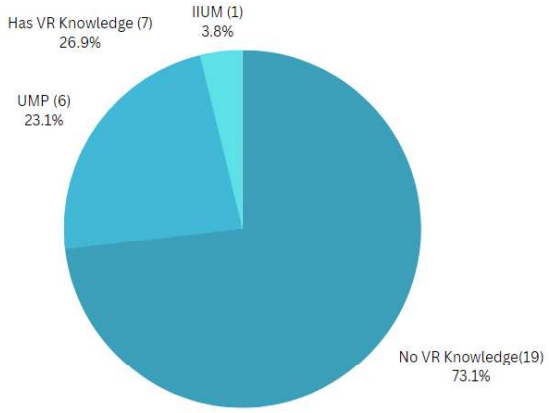

Figure 3. Breakdown of respondents with VR knowledge

Two respondents (R13 and R17) discussed acquiring knowledge through playing VR games and R17 discussed experiencing a virtual tour. Educator R6 stated that VR was applied to evaluate Final Projects while R13 experienced VR in the context of virtual clinic simulation. Two respondents, R9 and R19, used VR for teaching (R9 used VR for 1 semester and 4D Augmented Reality for almost 3 years, while R19 used VR for 2 lessons in the context of research). As illustrated in Figure 3, 6 out of 7 educators who had VR experience were from UMP and 1 from UiTM. The number of educators with VR experience, however, remains relatively low. Additionally, all respondents agreed that students would likely find learning with VR in ROL enjoyable and engaging. Reasons given by those who expressed reluctance to use VR in teaching and learning (Q6) ranged from high costs to technical difficulties.

For Question 5, 3 out of the 26 respondents did not provide reasons for their belief that students would enjoy using VR for remote online classes (R9, R10, R24). The reasons provided by the remaining 23 respondents were analyzed and categorized into four themes. By categorizing the responses into these themes, we gain a better understanding of the educators' considerations and challenges associated with integrating VR into ROL environments. The themes are as follows:

Theme 1: VR replicates real contexts

In Theme 1, based on the responses provided, the educators perceived that VR, by replicating real contexts, provides students with opportunities that they would not otherwise have access to within the bounds of traditional tertiary education. This sentiment is emphasized by the comments provided by R22, R25, and R26. With VR, students can engage in various activities, explore different environments, and gain experiences that were unimaginable before (R25). VR also has the potential to transform abstract concepts into tangible encounters and simulate realistic scenarios, such as lab sessions or clinic settings, providing enhanced visualization and a more immersive learning experience (R26). In a different setting, Kocur et al. (2020) investigated the impact of missing fingers in VR to prove how immersive the VR experience is and introduced the concept of phantom pain and avatar realism. Ultimately, VR's ability to replicate real contexts would

empower students by granting them novel experiences, exposing them to diverse environments, and fostering a sense of discovery and engagement that surpasses the limitations of traditional educational settings.

Theme 2: VR increases learners' engagement and enjoyment

Theme 2 represents how the educators (7 respondents) view VR from the students' perspective, in other words, how they are perceived to feel when they in "immersed" (R24) in VR if it is employed in remote online teaching. When students are exposed to novel experiences offered by VR, it naturally captures their attention and engages them in the learning process by easing their understanding (R16) as it shifts the learning process from passive to active (R5) making learning more interactive (R18). The interactive nature of VR enables students to actively participate and manipulate virtual objects resulting in a more dynamic and immersive learning experience (R24, R13). This finding is aligned with Allcoat and von Mühlenen (2018) that reported about the increase in students' engagement when using VR as compared to conventional teaching methods. Complex concepts can be visualized and explained in a more intuitive and accessible manner through virtual simulations, fostering a deeper level of engagement and understanding. As a result, students become more present, motivated, and invested in their lessons, actively involved in their own learning, and making the learning process more captivating and memorable.

It is also worth noting that VR is perceived to be able to accommodate different learning styles, enabling students to reach their VARK (i.e., visual, auditory, and kinesthetic) potential (R14). Moreover, VR facilitates collaborative activities and discussions within the virtual space, promoting student interaction and peer learning. Students can engage in collaborative projects, exchange ideas, and learn from one another, further enriching their educational experience. Lastly, VR resonates with today's digitally native generation, aligning with students' interests and preferences (R2). VR makes the learning journey more relatable, appealing and engaging for students as it is a technology that can reflect daily digital experiences.

Theme 3: VR creates novelty in learning context

Within this theme, a group of educators (consisting of five respondents) recognizes the potential of VR as a fresh and engaging method for delivering lessons. They view VR as a new approach, distinct from conventional one-way instructor-led methods, which are often considered monotonous and uninspiring. These educators understand the limitations of traditional online teaching and perceive VR as a more enjoyable and novel instructional tool. Similar to the findings of Dube et al. (2022), the educators believe that exposure to new and unfamiliar experiences, such as VR, can enhance skill development. At the same time, educators caution against using VR solely for entertainment, instead suggesting that it should be properly aligned with curricular objectives to ensure meaningful instructional experiences and meaningful ROL. They are careful to maintain a connection between VR activities and the subject material (R15), as they understand this is necessary to make the most of VR as an educational tool (R18). Consequently, educators need to be mindful when incorporating VR into their lesson plans, being sure it is relevant to the subject and beneficial to students. In conclusion, the

potential of VR to enhance learning should be weighed with its practicality in mind.

Theme 4: VR overcomes certain learning challenges

Theme 4 delves into the challenges that educators could foresee when adopting VR into ROL. One of the barriers identified is the availability of VR which R21 stressed that without proper technologies and materials, students will not be able to gain the true VR experience. Additionally, R20 points out the influence of student attitude and learning preferences when the educators tried to adopt VR. In accordance with this, R3 suggests that VR could potentially bring more benefits to those who are more visually inclined in ROL settings. Educators should consider factors such as students' needs and preferences when adopting VR in ROL while ensuring access and alternative approaches so that it promotes positive learning experiences. These concerns are legitimate as there are studies that showed that despite the use of VR, students did not perform well (Hamilton et al., 2021). An example Hamilton et al. (2021) cited is the study by Parong and Mayer (2018) who found that students who used VR during a biology lesson scored significantly poorer than those who learned using a PowerPoint. Another was by Makransky et al. (2017) whose findings show a similar decrease in students' performance. Both studies believed that it was possible that the high-fidelity graphics and animations of the VR applications used could have significantly increased cognitive load, which would have detracted from the learning task at hand. As such, suitability of VR and alignment to the learning outcomes are valid reasons not to use VR if it does not serve the purpose. Hamilton et al., (2021) therefore proposed a well-designed PowerPoint presentation would have facilitated better learning outcomes than the graphically rich VR experience. Ultimately, educators demonstrate a strong understanding of the potential impacts of VR in ROL environments, noting its immersive and interactive qualities, capacity to cater to different learning styles, encouragement of collaboration, and alignment with student interests.

However, educators also acknowledge the challenges associated with implementing VR in remote online teaching, particularly regarding accessibility as not all students have equal access to this technology. By acknowledging both the benefits and limitations of VR, educators demonstrate a balanced understanding of its potential within the educational landscape. This recognition of VR's strengths and challenges paves the way for further exploration and discussion on how to address accessibility issues and maximize the benefits of VR technology in ROL environments.

Malaysian Tertiary Educators' Readiness

To gauge educators' readiness and willingness to use VR for remote online teaching, two direct questions (Q6 and Q7) were posed. The findings from Q6, which explores educators' interest in using VR for teaching, will be discussed first, followed by the findings from Q7, which explores the issues educators foresee if VR is used for remote online teaching.

Q6 is "Would you be interested in using VR for teaching? Why?" Among the 26 respondents, 22 expressed their

interest in using VR for remote online teaching, while 4 indicated otherwise. Of those who answered "No," one respondent had prior experience using VR for the purpose of research and highlighted that VR would only be considered if it was research-related and if learners had access to the necessary tools and resources. As for the remaining 3 respondents who answered "No," one did not provide any specific reason (R24). R3 mentioned the lack of alignment between the current syllabus and VR as a deterrent for VR application for remote online teaching, while R15 also expressed concerns regarding the required equipment and time commitment.

For the remaining 22 respondents who expressed their interest in using VR for teaching, their provided reasons were analyzed and categorized into 3 themes:

Theme 1: Novelty

Seven respondents (R1, R4, R7, R10, R18, R20, R25) mentioned that they would use VR because it represents a "new method/new technology" to enhance teaching. They stated that using VR allows them to stay "up-to-date" and "catch up with technology," enabling them to make use of the latest advancements in teaching methodologies. These reasons align with the educators' perspectives on why they believed students would enjoy VR, as discussed in Q5. However, it is important to note Jang et al.'s (2021) findings regarding introducing VR and AR to 292 in-service elementary school teachers in Korea. In their research, it was found that when new technologies are introduced, or even required to be used, teachers can often become reliant on social conventions and organizational prerogatives, rather than adhering to their own educational beliefs. This can lead to teachers making their own decisions, regardless of outside influences.

Theme 2: Positive impacts on students' learning

Theme 2 reflects the educators' concern for learner engagement and their recognition of the benefits that VR potentially brings to students if employed for remote online teaching. They believe that using VR would enhance the effectiveness and improve online teaching, enriching teaching and learning to make it more interesting (R7, R16, R21). Five respondents mentioned that VR would be interesting, fun, and promising (R4, R10, R11, R13, R22). Three respondents highlighted the importance of VR being able to engage and increase students' interest (R8, R17, R23), as well as retain their interest and enhance teaching and learning (R7, R22, R25). The findings concurred with Cooper et al.'s (2019) findings where most of the pre-service teachers highlighted the positive impacts that VR has on students' learning. One of the reasons given was VR offers students the chance to explore new space without leaving the classroom such as learning about pyramids. The educators in this study also recognized other positive impacts such as that VR could provide an immersive learning experience (R5), enhance knowledge visualization (R6), facilitate the learning of clinical skills and anatomy subjects (R13, R14), and optimize learning during the pandemic and remote learning situations (R22, R26, R9). These reasons demonstrate their motivation to use VR for teaching, driven by the desire to create a more engaging and effective learning environment for their students.

Theme 3: Personal interest and motivation

Theme 3 provides valuable insights into the personal motivations and interests of educators regarding the integration of VR in ROL. The respondents expressed that they are fascinated with the idea of using VR, while R21 mentioned doing it "for the experience." Moreover, R12 highlighted their curiosity as a driving factor. These responses indicate that educators are personally captivated and driven by the potential of VR in diverse teaching approaches. The inquisitiveness and eagerness to explore VR originate from the aspiration to embrace this cutting-edge technology, showing their proactive attitude towards improving their teaching methods. These findings highlight that educators acknowledge the potential advantages of utilizing VR in learning; the belief in VR as a novel, captivating, and powerful tool to advance students' learning in remote seminars. The interest in VR is rooted in the anticipation of positive impacts on student engagement, motivation, deepening knowledge, and the ability to adapt to the challenges posed by the pandemic. As stated by Virmani et al. (2022), VR's three basic characteristics are Immersion, Interaction and Imagination. The immersive nature of VR, combined with its interactive capabilities and capacity for stimulating imagination, using VR would certainly impact students' learning positively in the education field. By providing engaging and realistic experiences, promoting active participation, and fueling creativity, VR holds great potential for enhancing educational experiences and empowering students in their learning journeys Additionally, educators' personal curiosity and interest contribute to their readiness to experiment and implement VR in their teaching practices.

When educators were asked about the potential issues they foresee if VR is used for ROL in Q7, their responses were analyzed and categorized into five themes. These themes provide insights into the educators' readiness to adopt VR in their remote online teaching practices. However, it is important to note that one respondent did not provide a reason (R24). The themes are as follows:

Theme 1: Relevance and Practicality

In Theme 1, only one respondent highlighted concerns about VR not being relevant to the course (R15). However, after having responded as such, R15 demonstrated willingness to attempt to use VR if it is cost-effective and not cumbersome for both self and students. According to Hamilton et al. (2021), a study done by Allcoat and von Mühlenen (2018) found that the complexity of VR obstructed learning outcomes due to the unfamiliarity and novelty of the technology. This shows the importance of providing a period of free navigation or extending some time for familiarisation to use a new technology would be helpful for educators or new users of technology (Hamilton et al., 2021).

Theme 2: Knowledge and Technical Factors

This theme reflects the respondents' lack of familiarity with using VR. R9 stated that to use VR, one would need to understand the hardware and software involved. Other respondents highlighted the requirement for specific hardware for VR and the need to have expertise in VR content creation (R11, R6). These concerns were valid as

Jang et al. (2021) stated that teachers' knowledge of integrating the technology into their classrooms is one of the four variables that impact teachers' use of that particular technology. The other variables are supportive culture, self-efficacy, and pedagogical belief.

Theme 3: Technology Limitations

In Theme 3, educators highlighted various challenges associated with the technological aspect of using VR for remote online teaching. One notable concern the respondents raised was the issue of cybersickness (R5, R9). Cybersickness is the motion-sickness-like discomfort such as oculomotor discomfort, eyestrain, and nausea (Yip & Saunders, 2023) experienced by individuals when using virtual reality due to the sensory disconnect between virtual and physical environments (Li et al., 2023). This may affect the learning experience and hinder some students from fully appreciating VR. Additionally, the educators were aware that technical glitches may occur and identified the glitches as significant factors that could impede the adoption of VR in online teaching (R10, R12). Recognising potential obstacles may assist educators to take precautions to smooth VR implementation in remote learning settings. For example, Yip and Saunders (2023) found that the severity of cybersickness can be reduced by minimizing the processing of peripheral motion cues and restricting attention to the central visual field.

Theme 4: Human Factors

Theme 4 represents the educators' awareness towards concerns related to their age factor and the necessity of convincing 'more senior' educators to use VR (R22, R3). This factor is indeed a primary reason why VR is under-utilised. This is not hard to imagine as instructors were having technical problems with much simpler technology, as reported by Anastasakis et al. (2021). Furthermore, educators also expressed concerns about potential resistance or unwillingness from students to embrace VR (R23).

Theme 5: Accessibility and Resources

The last theme is the theme with the highest concerns highlighted by the educators. Issues regarding access and resources were prominent within this theme, such as the affordability of VR for students, budget allocation, data usage, the cost of VR devices, acquiring necessary equipment, and the use of head-mounted displays (R14, R26, R15, R8, R25, R20, R5). Educators emphasized the need for adequate tools and monitoring and mentioned the requirement for additional devices (R19, R18).

Additionally, educators expressed concerns about internet stability, connectivity, technical issues, and low connectivity, highlighting the importance of stable internet connections for successful VR implementation (R1, R2, R23, R24, R7). One educator (R3) specifically pointed out the challenge of high-speed internet requirements for students. Another (R13) specifically also pointed out that the issue of device compatibility must be resolved first, only then will the students have equal access to VR. These issues highlighted support the findings by

Anastasakis et al. (2021) who looked at barriers in online learning for undergraduates in Greece. Anastasakis et al. (2021) found among the issues these students faced during the pandemic, technical problems (i.e., internet connection issues while online classes were going on) was ranked first (559 of 2608 responses). Students also faced other issues like not having access (119 responses) to online learning as some students did not even own a laptop and some did not have access to an internet connection. Such problems are common and until these issues are resolved, there will be students who will be left behind.

Conclusion

The study findings have identified three distinct categories that reflect educators' awareness and readiness regarding the adoption of VR. In Category 1, we have found educators who are ready to embrace VR. These individuals hold positive views on both PU and PEOU of VR, leading them to enthusiastically consider integrating it into their teaching practices. They firmly believe that VR is beneficial and user-friendly. In Category 2, we find educators who are hesitant about using VR. They perceive VR as highly useful, but their PEOU is relatively lower. Consequently, their intention to adopt VR is not as strong. Interestingly, none of the participants in this study disagreed with the PU of VR. This emphasizes the significance of addressing factors related to PU, such as learning requirements, necessary devices and stable internet connectivity. Addressing this concern can play a crucial role in boosting the likelihood of VR adoption among educators in this category. Lastly, Category 3 includes educators who have yet to experience VR firsthand. Since they have not had the opportunity to try it, their PEOU remains unknown. However, they hold a positive view of the PU of VR and demonstrate a readiness to adopt it once they become familiar with its ease of use. This suggests that they can recognise the potential benefits VR can offer and are open to exploring its capabilities once they gain hands-on experience. To summarize, the study findings have unveiled three distinct categories of educators based on their awareness and readiness towards VR adoption via the framework of TAM (Davis, 1989) by looking at PU and PEOU. Within Categories 2 and 3, which consist of educators with high perceptions of both PU and PEOU, we can distinguish two subgroups. The first subgroup are educators who are ready to adopt VR in their ROL despite having no experience using VR themselves. They are willing to explore VR due to the potential it holds as they recognise the benefits that VR will offer in their teaching practices.

On the other hand, the second subgroup are educators who are not ready to incorporate VR in their ROL. Their reluctance is based on the external factors they highlighted which includes age (e.g., too old), time constraints (i.e., need to learn), as well as the perceived unsuitability of VR to achieve learning outcomes. This subgroup could be likened to a group of people who have a strong desire to engage in exercise because they are well aware of and they understand the benefits of exercise for fitness and health, but personal shortcomings and challenges limit them. In considering the categories, educators can decide which group they fit into. It is clear that readiness is indeed influenced by educators' awareness, in particular of the PU and PEOU of VR, and even if VR is perceived highly in terms of PU and PEOU, there are other factors that make educators wary to embrace VR such as how to use VR correctly, or accessibility of VR in terms of suitable technologies and the

opportunities to acquire VR resources, to name a few. As such, the integration of VR in ROL is more as an aspiration than something actually practical.

It can be concluded that while the majority of educators may have limited knowledge or experience with VR, they unanimously recognize its benefits and potential for engaging and interesting students. Educators who have taught using VR are particularly more aware of its challenges. However, they believe that VR could be effectively used for remote online teaching if accessibility issues are addressed.

Recommendations

Recommendations are usually based on limitations of the study, and this study is not without its limitations. The first limitation would be the sample size, which is relatively small with a sample size of 26 respondents. This limited sample may not fully represent the diverse perspectives and experiences of all educators in the Malaysian tertiary education system. Future research may want to increase sample size as conducting a study with a larger and more diverse sample of educators could enhance the representativeness and generalizability of the findings.

The second limitation would be the generalizability. The scope of research was limited to Malaysian tertiary educators; hence, the findings may not be applicable or generalizable to educators in other contexts or regions. Cultural, educational, and technological differences could also impact the results and limit their broader applicability. Furthermore, future research may want to view it from the students' perspective by examining the actual impact of VR integration in remote online teaching on student engagement, learning outcomes, and satisfaction to assess the effectiveness and benefits of using VR in educational settings.

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