wjert, 2025, Vol. 11 Issue 4, 332-349.

Original Article

ISSN 2454-695X

World Journal of Engineering Research and Technology

WJERT

www.wjert.org

SJIF Impact Factor: 7.029

VIRTUAL REALITY PSYCHOLOGICAL AND EDUCATIONAL IMPACT ON UNIVERSITY STUDENTS

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Article Received on 11/02/2025 **Article Revised on 02/03/2025** **Article Accepted on 22/03/2025**

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ABSTRACT

The potential benefits of Virtual Reality (VR) in education could facilitate experiential learning by allowing students to explore complex scenarios and environments. This study aimed to investigate the impact of VR technology on student engagement and learning outcomes in higher education to understand the extent to which VR can enhance educational experiences and outcomes. This study had a cross-sectional design that carried out between August and October 2024 with a sample size of 250 students. The survey's first section consists of general questions regarding examinees. Questions about the feasibility of VR systems in education make up the second section, which consisted of three subcategories, including: Respondents prefer to use ahead-mounted displays (HMDs)VR over a 2D display. Respondents believe that the use of VR systems would increase interest in certain teaching content, and respondents believe that the introduction of interactive media (in this case, VR systems) into the curriculum would improve learning outcomes. 35.2% of respondents agreed and 31.6% strongly agreed that they felt present when using VR. A significant percentage of participants (38.0% strongly agreed, 16.8% agreed) believed that the use of VR systems and interactive content would increase their interest in the courses. Respondents also stressed the necessity of applying theoretical knowledge to actual circumstances. Respondents prefer VR over 2D screens, highlighting that VR as an interactive tool can enhance interest in instructional materials and improve learning outcomes.

KEYWORDS: Virtual Reality; Technology; Learning; psychological impact; Educational impact; university students.

1. INTRODUCTION

The journey of educational technology has been remarkable, evolving alongside societal needs and the quest for effective teaching methods. From oral traditions to modern digital tools, each advancement has shaped how knowledge is shared and acquired (Ha et al., 2023).Education began with storytelling, where knowledge was orally passed down (J. Yu et al., 2024). The 15th century invention of the printing press marked a pivotal moment, enabling mass book production and making written knowledge accessible (Li et al., 2023). This innovation laid the foundation for formal education systems with standardized curricula. The 20th century introduced audiovisual aids, such as filmstrips and educational television, enhancing student engagement (Al Amri et al., 2020).

The 1960s and 1970s saw programmed instruction and computer-assisted learning integrate technology into education, leading to the widespread use of personal computers in the 1980s (Alhalabi, 2016). The late 1990s brought the internet, revolutionizing education by expanding information access and facilitating online learning (Güney, 2019). Multimedia learning emerged as a significant advancement, combining various media to cater to different learning styles (Radianti et al., 2020). As we entered the 21st century, mobile technology reshaped education further, allowing students to learn anytime and anywhere (Richards & Taylor, 2015). Learning Management Systems (LMS) streamlined course management for educators while organizing resources for students (Lähtevänoja et al., 2022). Among these advancements, VR stands out as a promising technology that creates immersive environments for experiential learning (Yang et al., 2010).

Virtual Reality (VR) technology simulates environments that allow users to interact with three-dimensional spaces as if they were physically present (Sun et al., 2021). This immersive experience enhances learning by providing opportunities for engagement often lacking in traditional methods (Hui et al., 2022). VR can be categorized into immersive and non-immersive types. Immersive VR fully envelops users using head-mounted displays (HMDs), while non-immersive VR allows interaction through standard computer interfaces without sensory immersion (Makransky et al., 2019). The effectiveness of VR in education relies on technological components like HMDs, motion sensors, and handheld controllers that enhance user interaction in real-time (Villena-Taranilla et al., 2022). Interactive simulations replicate complex scenarios difficult to recreate in physical classrooms, fostering deeper understanding by allowing practical application of theoretical knowledge (Yang et al., 2010).

Current Trends in Higher Education:

The integration of VR in higher education is rapidly gaining traction, reshaping student engagement and learning outcomes. This trend is driven by a desire for enhanced engagement through immersive experiences that traditional methods cannot match. For example, VR can transport students to historical sites or simulate surgical procedures, offering practical experiences without physical constraints (Ai-Lim Lee et al., 2010). Traditional lectures often fail to capture attention, leading to disengagement; however, VR fosters active participation. A study at the University of Sydney reported a 250% increase in student participation in VR labs over two years, with 71.5% indicating improved learning outcomes (Lorenz et al., 2018). Additionally, VR addresses diverse learning needs by providing personalized experiences that cater to different styles (Ugwitz et al., 2019).

Despite its potential, implementing VR in education presents significant challenges. One major issue is the high cost of VR hardware and software, which can be prohibitive for many institutions with limited budgets (31). Accessibility is another concern; not all students have equal access to VR technology, particularly in low-resource areas. Furthermore, technical complexities can overwhelm educators lacking necessary skills for setup and maintenance (Makransky & Petersen, 2021). Cognitive overload is also a risk; while VR can enhance engagement, it may distract students if not designed thoughtfully. Issues such as motion sickness from headsets can deter participation (Howie & Gilardi, 2021). Moreover, ensuring that VR content is relevant and pedagogically sound remains a challenge due to a scarcity of high-quality applications that align with curriculum goals (Howie & Gilardi, 2021).

Research indicates that VR positively influences student learning outcomes by enhancing cognitive, behavioral, and affective engagement. Studies show that immersive experiences significantly improve understanding of complex subjects through deeper cognitive engagement. Notably, at-risk students often thrive in VR environments due to personalized learning experiences tailored to their needs (Wu et al., 2021). However, gaps remain in measuring engagement metrics related to VR use; existing studies often overlook how different types of engagement can be quantitatively assessed within these contexts (Johnson-Glenberg et al., 2021).

Future research should focus on longitudinal studies examining VR's long-term impact on academic performance. While short-term benefits are documented, understanding how these effects persist over time is crucial. Interdisciplinary applications of VR also warrant investigation; current literature primarily focuses on specific subject areas without exploring broader integrations across disciplines (Ouyang et al., 2022). Additionally, research should delve into cognitive and emotional aspects of learning in VR environments since emotional engagement plays a significant role in outcomes.

2. MATERIALS AND METHODS

A cross-sectional design was carried out to assess the relationship between the use of VR technology and levels of student engagement and learning outcomes at a specific point in time. It was conducted between August and October 2024. All medical undergraduate and graduate students enrolled in courses that incorporated VR technology was the target population. A sample size of 250 students was targeted to ensure statistical power. Respondents who freely filled out the questionnaire were the subjects of the survey.

Measuring tools: The Likert scale was used to assess respondents' attitudes and the acceptability of implementing VR equipment in the classroom. The scale's assertions were chosen after a review of the literature on the subject of VR systems' impact on users, their immersiveness, and their efficacy in teaching. In order to include as many participants from a variety of demographic backgrounds as possible, the questionnaire was administered in English.

The "Google Forms" tool was used to produce the survey, which was then shared on a number of online discussion boards. Participants volunteered to complete the anonymous questionnaire. Participants were ensured that their responses would remain confidential and were voluntary. The participants' thoughts served as the sole foundation for the questionnaire. The questionnaire's background and goal were briefly explained at the outset. General demographic questions were asked of the respondents in the first section of the questionnaire. The Likert scale served as the basis for the longer portion of the questionnaire. Control questions were provided, and the assertions were connected to the presumptive hypotheses. The questionnaire took an average of six minutes to complete.

Regarding the questionnaire in the present research, a validated instrument (e.g., the Student Engagement Instrument) was developed or adapted to measure different dimensions of student engagement (behavioral, emotional, and cognitive). The survey's first section consists of general questions regarding examinees. Questions about the feasibility of VR systems in education make up the second section, which consisted of three subcategories, including: Respondents prefer to use an HMD VR over a 2D display. Respondents believe that the use of VR systems would increase interest in certain teaching content, and respondents believe that the introduction of interactive media (in this case, VR systems) into the curriculum would improve learning outcomes.

Data were analyzed using the IBM® SPSS statistical software, version 27. We used the one-sample Kolmogorov-Smirnov test to check the normality of data, and the data were parametric. Numerical data was presented as mean and standard deviation (SD), and categorical data was presented as number and percentage. A student t-test was used to compare the means in different groups. The level of significance was adopted at $p<0.05$.

3. RESULTS AND DISCUSSION

A total of 250 individuals participated in the current study, with a mean age of 24.56 years, as illustrated in **Table (1)**. The gender distribution indicated a predominance of male participants (64.4%) compared to females (35.6%). Nearly half of participants were first-year students (52.8%) and 14.8 from the 2nd year. A smaller proportion of participants had previously used VR technology in their studies (34.8%).

Table (2a) pointed out thatparticipants strongly preferred HMD VR systems over conventional 2D screens. Time passed more quickly when utilizing VR systems, according to the majority of participants (28.0% strongly agreed and 30.4% agreed) (T1). Notably, 35.2% of respondents agreed and 31.6% strongly agreed that they felt present when using VR (T2). T3 revealed that although some participants acknowledged they were in a virtual setting (28.8% strongly agreed), a sizable portion remained neutral (37.2%). With 19.6% strongly agreeing and 38.0% agreeing that VR allowed for more than passive content consumption, users valued the active interaction that VR provided (T4). Remarkably, T5 showed that a significant portion of participants (51.6%) found complete immersion in VR frightening. Lastly, the visual stimuli in VR were generally well-received, with a mean score of 3.63 (T6).

While **Table (2b)** demonstrated that most respondents thought that using VR systems would increase students' interest in the material being taught. A significant percentage of participants (38.0% strongly agreed, 16.8% agreed) believed that the use of VR systems and interactive content will increase their interest in the courses (T9). With 57.6% of respondents concurring that shared experiences are significant in a collaborative setting, respondents also acknowledged the importance of these experiences (T10). 50.8% of participants believed that visual representation helps with comprehension, according to the findings on abstract concept understanding (T8). Although many people thought that VR could encourage active learning (T13), 42.0% was neutral.

Furthermore, a mean score of 3.90 (T15) indicated that most people (79.6%) agreed or strongly agreed that VR may make learning more enjoyable. Interestingly, T12 showed that 63.2% of participants said that face-to-face interaction was essential, suggesting that an overdependence on technology may be a cause for concern. T16 stated that 60.8% of respondents thought VR would be distracting. This suggests that cautious implementation is necessary to minimize any potential negative effects.

Table (2c) showed the majority (30.4% agreed, 22.0% strongly agreed) stated that interaction was essential for good learning (T17). Respondents also stressed the necessity of applying theoretical knowledge to actual circumstances, although the mean score of 3.16 for this item (T18) indicated a more split opinion, with a considerable proportion disagreeing. 79.6% agreed that students should primarily engage with one another, with the lecturerserving as a facilitator rather than the center figure of information. In contrast, T20 revealed an opposing attitude, with 34.0% disagreeing that the lecturershould lead the talks, implying a conflict between traditional and participatory teaching approaches.

Table (3)clarified that participants aged 20 to 25 had lower mean scores (3.56), whereas those over 30 had the most positive attitudes (mean score of 4.13) with the statistical significance ($p = 0.001$). The mean score of male respondents was higher (3.81) than that of female respondents (3.51), and the difference was statistically significant ($p = 0.01$). The participants who previously utilized VR technology showed significantly more positive attitudes (mean of 3.87) than those who had not (mean of 3.55), with a highly significant p-value of 0.001. However, when the level of education was examined, the differences in attitudes were not statistically significant ($p = 0.32$).

Table (1): Socio-demographic data among the study participants.

Item	Demographic data	Study participants (n =250)	
		No.	%
Age / year	Min–Max	21– 34	
	Mean + SD	24.56 + 6.48	
Gander	Male	161	64.4
	Female	84	35.6
Educational grade	1st year	132	52.8
	2nd year	37	14.8
	3rd year	5	2.0
	4th year	49	19.6
	Graduate	27	10.8
Previously used VR technology in the studies	Yes	87	34.8

Table 2a: Users preference to use an HMD VR system over a 2D display.

Statements	Strongly agree	Agree	Neutral	Strongly disagree	Disagree	Mean	SD
T1: Time passes faster for me while I consume content via a VR system compared to consuming content via regular 2D displays.	70(28.0%)	76(30.4%)	60(24%)	34(13.6%)	10(4%)	**3.65**	**1.14**
T2: While I use a VR system, I feel like I am present in a virtual world.	79(31.6%)	88(35.2%)	46(18.4%)	11(4.4%)	26(10.4%)	**3.73**	**1.24**
T3: While I use a VR system, I am always aware that I'm in virtual world and that none of it is real. *	72(28.8%)	44(17.6%)	93(37.2%)	35(14%)	6(2.4%	**3.56**	**1.18**
T4: With VR, I'm not limited to passively consuming information and images displayed on the screen.	49(19.6%)	95(38%)	86(34.4%)	9(3.6%)	11(4.4%)	**3.65**	**0.98**
T5: Complete immersion in the virtual world frightens me. *	129(51.6%)	45(18%)	29(11.6%)	42(16.8%)	5(2%)	**4.00**	**1.21**
T6: The visual stimuli provided by VR systems is fascinating to the users.	81(32.4%)	65(26%)	46(18.4%)	47(18.8%)	11(4.4%)	**3.63**	**1.26**

Table (2b): Respondents believe that the use of VR systems would increase interest in certain teaching content.

Statements	Strongly agree	Agree	Neutral	Strongly disagree	Disagree	Mean	SD
T8: It's difficult for me to understand abstract contents and concepts (e.g., energy transfer and similar) without a visual representation of the same.	47(18.8%)	80(32.0%)	95(38.0%)	10(4.0%)	18(7.2%)	**3.51**	**1.69**
T9: I think that my interest in courses and educational content would be higher if interactive content and VR systems were used.	95(38.0%)	42(16.8%)	24(9.6%)	67(26.8%)	22 (8.8%)	**3.48**	**1.44**
T10: The group's shared experiences in a shared environment are important.	45(18.0%)	144(57.6%)	45(18.0%)	8(3.2%)	8(3.2%)	**3.84**	**0.88**
T11: Stimulation of multiple senses leads to a better understanding of educational content.	52(20.8%)	65(26.0%)	59(23.6%)	43(17.2%)	3 (12.4%)	**3.26**	**1.30**
T12: Interaction with the real people in the real world, whether they are lecturers or students, is necessary. *	55 (22.0%)	103(41.2%)	41(16.4%)	37 (14.8%)	14 (5.6%)	**3.59**	**1.14**
T13: While using VR systems, students can actively learn and participate, instead of passively looking at 2D displays.	55 (22.0%)	76 (30.4%)	105(42.0%)	5 (2.0%)	9 (3.6%)	**3.65**	**0.96**
T14: Being able to see and experience the various locations around the world within the classroom provided by VR can inspire and intrigue students.	54 (21.6%)	38(15.2%)	67(26.8%)	76(30.4%)	15 (6.0%)	**3.16**	**1.241**
T15: Introducing VR into the classrooms turns learning into entertainment.	66 (26.4%)	133(53.2%)	22(8.8%)	19(7.6%)	10 (4.0%)	**3.90**	**1.005**
T16: Using a VR system would distract students from the educational content. *	55(22%)	97(38.8%)	35(14.0%)	27(10.8%)	36(14.4%)	**3.43**	**1.31**

Table (2c): Opinions of the respondents with regard to the belief that employing VR in education and in the curriculum would improve learning outcomes.

Statements	Strongly agree	Agree	Neutral	Strongly disagree	Disagree	Mean	SD
T17: People learn better through interaction.	55(22.0%)	76 (30.4%)	105(42.0%)	5 (2.0%)	9 (3.6%)	**3.65**	**.963**
T18: Through the learning process, it's necessary to apply theoretical knowledge to practical examples in order to master a new skill.	54(21.6%)	38(15.2%)	67(26.8%)	76(30.4%)	15(6.0%)	**3.16**	**1.241**
T19: In the classrooms, there should be mostly interaction between students (the lecturer only serves as a "guide" to the conversation).	66(26.4%)	133(53.2%)	22(8.8%)	19(7.6%)	10(4.0%)	**3.90**	**1.005**
T20: In classrooms, the lecturershould lead the keynote, i.e., the lectureris the main source of information and interaction. *	48(19.2%)	73 (29.2%)	39(15.6%)	85(34.0%)	5 (2.0%)	**3.30**	**1.182**
T21: The classical evaluation system in education (e.g., exams) does not reflect the real knowledge of the respondents.	70(28.0%)	68(27.2%)	90(36.0%)	7(2.8%)	15(6.0%)	**3.68**	**1.094**
T22: The classical evaluation system in education (e.g., exams) reflects the real knowledge of the respondents. *	61(24.4%)	54(21.6%)	25(10%)	40(16%)	70(28%)	**3.48**	**1.443**
T23: Evaluation tailored to the individual, where certain parameters of the respondents are monitored with the help of VR systems represents a better evaluation system.	42(16.8%)	120(48%)	53(21.2%)	26(10.4%)	9(3.6%)	**3.84**	**.868**
T24: Virtual environment models teach and train with the same efficiency as reality	69(27.6%)	57(22.9%)	106(42.4%)	7(2.8%)	11(4.4%)	**2.98**	**1.575**
T25: Unlike VR, which can provide an interactive experience, classical learning boils down to providing facts only.	35(14.0%)	103(41.2%)	43(17.2%)	56(22.4%)	13(5.2%)	**3.64**	**.997**
T26: VR develops students' creativity.	36(14.4%)	90(36.0%)	55(22.0%)	59(23.6%)	10(4.0%)	**3.66**	**1.049**
T27: With the help of VR, a student can learn how to react in certain (unknown, dangerous) situations.	79(31.6%)	71(28.4%)	70 (28.0%)	25(10.0%)	5 (2.0%)	**3.36**	**1.130**

Table (3): The relationship between socio-demographic variables and attitudes of respondents and the acceptability of the introduction of VR systems in education.

Demographic data		Study participants (n =250)				
		No.	Mean	SD	t-test	P value
Age / year	25 -20	131	3.56	0.76	14.25	0.001*
	26 -30	97	3.79	0.55		
	More than 30	22	4.13	0.74		
Sig. between groups		years 25-20and other groups				
Gander	Male	161	3.81	0.627	6.33	0.01*
	Female	84	3.51	0.80		
Educational grade	1st Year	132	3.61	0.77	1.36	0.32
	2ndYear	37	3.69	0.57		
	3rd Year	5	3.87	0.59		
	4th Year	49	3.95	0.37		
	Graduate	27	3.76	0.62		
Previously used VR technology in the studies	Yes	87	3.87	0.70	9.47	0.001*
	No	163	3.55	0.65		

4. DISCUSSION

Augmented reality (AR-based)learning's capacity to augment students' experiences, unsurprisingly, can lead to higher learning results (Lähtevänoja et al., 2022). Students who successfully complete AR-enhanced learning activities are more likely to improve their theoretical knowledge and practical skills. AR-based learning improves outcomes in several key areas of training, including professional knowledge, cognitive and practical abilities, social skills, innovation, competence, and creativity (Akman & Çakır, 2023). We examine the influence of AR-based programs on students' experience and learning outcomes.

Systems use VR technology to engage students' psychological reactions to being present or in a generated environment (Ai-Lim Lee et al., 2010).The 3D environment has a sense of presence due to its distinct features, representation, and high degree of human interaction or control(Lorenz et al., 2018; Ugwitz et al., 2019). There is a definite correlation between interest and involvement with the study findings, and VR offers concrete, useful instances of extending and expanding work into the real world (Voinov et al., 2018).

The current results showed that participants have a strong preference for HMD VR devices over regular 2D screens. This is consistent with previous research indicating that VR can dramatically increase user engagement and happiness (Voinov et al., 2018). The fact that time passed faster for the majority of participants while utilizing VR equipment is very notable. This can be linked to increased immersion and cognitive involvement, which is backed by research indicating that immersive settings can modify time perception (Ventura et al., 2019).

The present study also reported the majority of participants felt alive while using VR, demonstrating the technology's ability to produce immersive experiences that promote emotional and cognitive connections with information. Presence is an important component of VR that has been related to better learning outcomes and user happiness (Ventura et al., 2019). However, the varied reactions to knowledge of the virtual setting indicate variation in individual views. As previous research has shown, this diversity may be driven by human variables such as prior VR experience and unique cognitive processes (Lin & Lin, 2019).

Besides, 57.6% of respondents agreed that VR facilitates active contact, which supports the transition from passive consumption to active participation. It has been demonstrated that active VR use promotes deeper learning and retention, especially in educational settings. On the other hand, the fact that 51.6% of participants thought total VR immersion was frightening raises serious questions about the psychological effects of immersive technology. The intensity of the encounter or the fuzziness of the boundaries between virtual and real-world settings could be the source of this terror. Given that a previous study suggests that heightened immersion may cause increased anxiety in certain users, it is imperative to comprehend these emotional reactions(Makransky & Petersen, 2021).

As a result of the integration and type of educational technology used, as well as how well it supports structure, active learning, communication, and interaction between students and/or teachers, the included studies revealed how educational technology can engage students in higher education in behavioral, affective, and cognitive ways (Makransky & Petersen, 2021).According to ouroutcomes, participants strongly believed that using VR systems may increase students' interest in the lessons being taught. Respondents also emphasized the potential of VR and interactive content to further engage students. This supports earlier findings that immersive technology might increase motivation and interest in learning environments (Z. Yu, 2023).

Additionally, near to half of respondents acknowledged the value of shared experiences in collaborative situations. This demonstrated how VR can promote social connection and teamwork, two qualities that are essential for improving learning outcomes (Howie & Gilardi, 2021). Additionally, 50.8% of participants said that VR could help with grasping abstract topics, indicating that visual representation facilitates comprehension. This bolsters the claim that VR can be an effective tool in fields where conventional teaching techniques might not be as effective, especially in difficult subjects that lend themselves to visual and spatial learning methodologies (Howie & Gilardi, 2021). Although most respondents agreed that VR may encourage active learning, 42.0% had no opinion, implying that each person's VR experience differed greatly, suggesting that different students might react differently to immersive learning settings (Fowler, 2015).

Moreover, a significant majority agreed or strongly agreed that VR might make learning more fun, as demonstrated by the high mean score of 3.90 (T15). This result is consistent with previous research indicating VR's capacity to produce entertaining and interesting learning environments. Nonetheless, the information also showed that 63.2% of participants thought in-person communication was crucial (T12). Although VR can improve learning, it shouldn't entirely replace conventional human connections in educational settings, according to this research, which sparked worries about the possible overreliance on technology (Fowler, 2015).

Furthermore, 60.8% of respondents thought VR would be distracting (T16) suggesting that its use needed to be done carefully. The necessity for educators and developers to carefully craft VR experiences that optimize engagement while avoiding potential negative effects is highlighted by this understanding of potential distractions. It implies that the advantages of immersive learning as well as the significance of preserving a balanced strategy that incorporates in-person interactions must be taken into account for the effective incorporation of VR into educational practices (Johnson-Glenberg et al., 2021; Karich et al., 2014).

The current study also found that the majority of respondents believed that students should interact with one another more than the lecturer, who should be the primary authority figure; the desire for student-led interaction in the classroom was pronounced (T19). Peer interaction promotes deeper comprehension and collaboration, and this viewpoint is consistent with modern pedagogical practices that support student-centered learning. There appears to be a conflict between more interactive approaches and traditional, teacher-led learning, as evidenced by the contrary view expressed by T20, where 34.0% of respondents disagreed that academics should lead discussion. This dispute emphasizes how teachers must modify their pedagogical approaches to successfully integrate VR technology and student-led learning opportunities.[37]

While respondents showed general excitement for incorporating VR into education, doubts regarding traditional teaching techniques and VR's usefulness in specific situations were clear. T24 received conflicting replies regarding the usefulness of VR training in comparison to real-life experiences, highlighting a critical perspective. Some participants may be skeptical about VR's capacity to properly mimic the intricacies of real-world circumstances, which are critical for specific skills and disciplines. A significant 31.6% of respondents stated that VR might prepare pupils for difficult situations (T27), while the majority recognized its ability to boost creativity (T26). This shows that participants considered VR not only as a tool for participation but also as a way to foster creative problem-solving abilities (Fowler, 2015).

Near to half of participants believed that tests do not accurately reflect real knowledge (T21), supporting the call for more individualized assessment methodologies. This feeling is consistent with the general trend toward formative evaluations that better capture student comprehension and capabilities, especially in VR situations where individualized feedback and adaptive learning pathways can improve the educational experience (Yang et al., 2010).

Participants' perceptions regarding VR technology differed significantly based on their age and gender. Participants aged 20 to 25 showed lower mean scores, whereas those over 30 exhibited higher positive attitudes. This suggested that age played a substantial role in molding views of VR in educational contexts. This finding shows that older participants may have more positive experiences or expectations of VR, either due to exposure to a broader range of technological breakthroughs or a stronger appreciation for novel teaching approaches (Howie & Gilardi, 2021).

Male respondents reported greater mean scores than female respondents. The difference was statistically significant, demonstrating that men were more open to the employment of VR technology in the classroom than women. This finding is consistent with prior research that demonstrates gender disparities in technology adoption and attitudes, with males typically showing greater enthusiasm for emerging technologies(Karich et al., 2014).

Participants with prior experience with VR technology exhibited considerably more positive opinions than those without. The significantly significant p-value demonstrated the importance of prior experience on perceptions of VR. This research emphasizes the relevance of hands-on experience in molding attitudes, as familiarity with VR is likely to increase confidence and interest in its potential educational uses (Karich et al., 2014).On the other hand, there were no statistically significant differences in attitudes according to educational level. This finding implies that participants' opinions about VR technology were not much impacted by their level of education, suggesting that attitudes may be more influenced by age, gender, and prior experience than by formal education (Fowler, 2015).

This study can help practitioners and educators because, first, the findings can theoretically and intellectually support the creation of VR environments and VR teaching designs for educational purposes, such as by assisting in the creation of a training platform for educational virtual simulation experiments. Second, by broadening the scope of embodied learning theory's applicability to various contexts, this study's findings will be useful for the widespread use of IVR in the future to support experiential and group-led instruction as well as the advancement of digital transformation and intelligence upgrading in the educational system. Third, in the context of an IVR learning experience, this study offers a preliminary theoretical model of the emotional components that impact learning results. This model can assist researchers in this field in conducting other related studies based on these findings.

5. CONCLUSION

According to the study, respondents would rather use an HMD VR than a 2D screen, and using a VR system as an interactive tool would boost interest in particular instructional materials and enhance learning results. The findings further support the benefits of VR systems, particularly since the study primarily includes young people who are still enrolled in school as well as those who have left and have firsthand knowledge of the situation and perspectives on the state of education today. Nonetheless, the findings imply that there is enthusiasm for utilizing new technologies. Whether in a virtual setting or an educational institution, social interaction is still crucial for responses, which must be considered.

Abbreviations

Virtual reality (VR), Learning management systems (LMS), Head-mounted displays (HMDs), Standard deviation (SD), and Augmented reality-based (AR-based).

ACKNOWLEDGMENTS

Not applicable.

Funding

The author received no funding for this publication.

Availability of data and materials

Available upon reasonable request.

Competing interests

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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