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Integrating Virtual Reality into Higher Education: Opportunities and Challenges in the Pakistani Context

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ABSTRACT

This study investigates the potential impact of Virtual Reality (VR) on higher education in Pakistan, focusing on its use at the university level. The research explores how VR can enhance the learning experience, its feasibility, and educators' and students' perceptions. A questionnaire was distributed to 130 participants, including faculty members and students, at various universities across Pakistan. The collected data were analyzed using descriptive statistics and one-sample t-tests to evaluate the respondents' views on VR in education. The results indicate a generally positive perception of VR, with participants agreeing that VR systems could enhance student engagement, foster more profound understanding, and make learning more interactive. While many participants lacked prior VR experience, they recognized its potential to transform educational practices, particularly through immersive, interactive content. However, some concerns were raised regarding the intimidating nature of virtual environments for newcomers, and the need for proper training and resources to ensure successful implementation. The study concludes that VR has the potential to revolutionize education in Pakistan, but its successful integration requires addressing challenges such as accessibility, infrastructure, and familiarization. The findings also suggest that further research is needed to assess the long-term impact of VR on student learning outcomes and its application across diverse academic fields.

Keywords: *Virtual Reality, Higher Education, Pakistan, Immersive Learning, Educational Technology, Student Engagement, Pedagogical Innovation*

INTRODUCTION

The integration of technology in education has dramatically transformed teaching and learning processes worldwide. Virtual Reality (VR), as an immersive technology, offers an interactive experience that simulates physical presence in real or imagined environments. In education, VR has been increasingly recognized for its potential to enhance learning by creating engaging and interactive experiences (Mikropoulos & Natsis, 2011). This innovative technology allows students to experience and interact with educational content in a virtual space, thereby improving understanding, retention, and the practical application of knowledge.

In Pakistan, the use of technology in higher education is still in its infancy, with traditional teaching methods still dominating university classrooms. However, recent advancements in digital tools, including VR, have opened new avenues for educational reform. Despite growing global interest in VR, widespread adoption remains limited in Pakistani universities. VR has the potential to revolutionize education by offering simulations for complex subjects, enhancing remote learning experiences, and providing opportunities for hands-on learning without the constraints of physical resources (Freina & Ott, 2015).

The use of Virtual Reality (VR) in education aligns with the theory of Constructivism, as proposed by Piaget (1972) and Vygotsky (1978), which emphasizes active learning and social interaction in the development of knowledge. According to Constructivist theory, learners build their understanding of the world through direct experience, problem-solving, and reflection. VR technology, by creating immersive, interactive learning environments, enables students to engage with content hands-on. This kind of active learning experience is particularly beneficial in fields such as science, engineering, and medicine, where the practical application of knowledge is crucial (Dede, 2009). Through VR, students can participate in virtual labs, field trips, and simulations, enhancing their comprehension and retention of complex concepts.

Moreover, the Cognitive Theory of Multimedia Learning, as articulated by Mayer (2005), suggests that individuals learn more effectively when information is presented through multiple modalities such as visual, auditory, and kinesthetic stimuli. VR, with its ability to integrate 3D graphics, audio, and interactivity, supports this theory by engaging multiple senses and improving cognitive processing. The immersive nature of VR allows learners to interact with 3D objects, visualize abstract concepts, and navigate complex environments, leading to deeper understanding and better retention of information (Zhang et al., 2017).

Despite its potential, the adoption of VR in education in Pakistan faces significant challenges. The country is still grappling with issues such as inadequate infrastructure, insufficient teacher training, and limited funding for technological innovation in higher education. However, with the increasing focus on digital literacy and e-learning platforms, VR holds promise as an effective tool for bridging the educational divide and enhancing the quality of education in Pakistan. Studies by Chen et al. (2016) and Slater & Wilbur (1997) have highlighted that VR has the potential to overcome barriers in traditional education, enabling personalized learning experiences and fostering collaboration among students in virtual spaces.

In conclusion, VR represents a promising avenue for transforming education in Pakistan by offering immersive, interactive, and engaging learning environments. However, integrating this technology into the educational landscape requires overcoming challenges related to infrastructure, training, and resource access. With the right policies and investments, VR has the potential to enhance university students' learning experiences in Pakistan significantly.

Virtual reality as a tool for enhancing education has not been extensively researched or applied in higher education in Pakistan. There is a need to explore how VR can be integrated into university-level education in Pakistan and its potential impact on learning outcomes. Given the diverse challenges faced by the Pakistani education system, including overcrowded classrooms, limited resources, and limited access to advanced learning materials, VR could help bridge these gaps. This research aims to examine the current state of VR use in universities and evaluate its potential to improve educational experiences at the university level in Pakistan.

The findings of this study will contribute to the growing body of knowledge on the use of VR in education, particularly in developing countries such as Pakistan. The results will provide insights into how VR can be leveraged to enhance educational experiences and outcomes in higher education

institutions. Moreover, the study will highlight barriers to VR adoption and offer practical recommendations to overcome them. The integration of VR into Pakistan's educational institutions could create a more engaging, interactive, and inclusive learning environment for students.

This study focuses on university-level education in Pakistan, specifically examining how VR technology can be implemented and utilized in various academic disciplines. The research will target both students and faculty members across selected universities to gather comprehensive data on their perceptions, experiences, and challenges related to VR usage. The scope of the study is limited to universities in urban areas, where technological infrastructure is more readily available.

Problem Statement

Although the world has seen a surge in the use of immersive technologies in education, the application of Virtual Reality (VR) in higher education in Pakistan remains limited. Traditional forms of teaching remain the norm in most universities, with less exposure to simulation or interactive learning. This limits students' opportunities to engage with complex ideas in an immersive way and does not give faculty the scope to adopt innovative pedagogical approaches. Without empirical data on how Pakistani educators and students view VR, institutions and policymakers lack the insights to inform investment, curriculum change, and training.

Significance of the Study

The research is significant as it offers one of the initial empirical explorations of Pakistani higher education's attitudes toward VR. By capturing students' and professors' perspectives across various fields, the research identifies avenues for increased involvement, retention, and interactivity in education. It also presents obstacles such as infrastructure, training, and accessibility that are invaluable to policymakers and institutions to tackle. The research contributes to the international literature on VR in education while offering context-specific suggestions for developing nations, particularly in South Asia.

Research Objectives

- To explore the impact of Virtual Reality (VR) on student engagement in educational content.
- To assess the potential of VR in improving the learning process compared to traditional methods.
- To examine the perceptions of students and educators regarding the integration of VR in higher education.
- To analyze the influence of demographic factors (gender, age, and education level) on experiences with VR in education.

Research Questions

1. How does Virtual Reality (VR) influence student engagement in higher education?
2. In what ways does VR improve knowledge retention compared to traditional teaching methods?
3. What are the perceptions of students and educators regarding the integration of VR in university classrooms?
4. How do demographic factors (gender, age, and education level) shape experiences with VR in education?

Organization of the study

The rest of this paper is structured as follows: Section 2 discusses the literature on VR in education, focusing on recent research and identifying the research gap. Section 3 describes the methodology,

including data collection, the sample, and analytical methods. Section 4 presents the analysis results, while Section 5 discusses the findings in relation to the existing literature. Section 6 concludes the study with key insights, Section 7 presents recommendations, and Section 8 presents the implications of this study.

LITERATURE REVIEW

Danish et al. (2018) examined the article Exploring the Effectiveness of Augmented Reality-based E-Learning Application on Learning Outcomes in Pakistan: A Study by VARK analysis and Hybrid Pedagogy. They claimed that the old mode of teaching had lost its efficiency due to the growth of the Industrial Revolution. They compared the learning outcomes and styles of two student groups: a control group and an experimental group. The t-test showed that hybrid pedagogy was more successful. In contrast, the VARK analysis showed that visual, auditory, reading/writing, and kinesthetic learning styles were used nearly equally by both groups. Notably, integrating an augmented reality (AR) e-learning application with conventional e-learning applications improved learning outcomes, especially when teaching renewable energy topics.

On this basis, Sattar et al. (2019) investigated the Impact of virtual reality training on the learning motivation and competency of medical students. They conducted research and examined the necessity of VR in medical education, comparing text, video, and immersive technologies. Eighty-seven fourth-year medical students (three public and five private) were involved in the study, and VR, video, and text-based resources were used to teach them laparoscopy. Learning motivation and competency were evaluated using questionnaires after each approach. The statistical t-test analysis showed that VR was the most effective method, compared with the other methods (video and text), which had statistically significant outcomes (P=0.000). The study concluded that VR improves learning motivation and competency and should thus be integrated into the medical education curriculum.

In a follow-up study, Rashid et al. (2021) examined the Educational environment of virtual reality in higher education: Bibliometric evidence of publishing trends and new directions. In this bibliometric study, the trends of research and productivity of VR in higher education were analyzed through Scopus data. The results demonstrated that interest in VR is increasing; the most significant number of citations was in 2009, and the most fruitful year was 2019, with 127 publications. The leading researchers, nations, and institutions in the field were mainly from developed countries, especially Australia, the United States, and the United Kingdom. Keywords such as virtual reality, augmented reality, and e-learning dominated VR research. The paper also emphasized the interdisciplinary appeal of VR, which extends beyond computer science into other disciplines. The thematic development indicated the enduring significance of the keyword Virtual Reality as a major term over 27 years.

Also in the same year, Asad et al. (2021) conducted a systematic literature review on Virtual reality as a pedagogical tool to facilitate experiential learning. They observed that the last 50 years have been marked by the blistering development of technologies that entail artificial intelligence and VR. As a computer-generated simulation, VR enabled users to interact with unreal environments, providing a learning experience in the education domain. It is based on a review of 26 articles examining the effects of VR software. There were nine themes, including VR as a communication method, social learning, and the learning experience. VR proved efficient across medicine, engineering, and language learning, increasing engagement and providing immersive experiences. The authors of the review found that VR made a significant contribution to students' experiential learning and their engagement in virtual space.

More recently, Farooqi et al. (2023) conducted a case study titled "Harnessing Interactive Media for Transformative Education in Pakistan: A Case Study of the Virtual Reality Integration." Their study examined the potential of VR to revolutionize education in Pakistan by enhancing student interaction,

knowledge retention, and critical thinking. VR offers students an interactive, immersive experience by allowing them to visit distant places, engage in virtual activities, and build real-life skills. Earlier research highlighted the positive effect of VR on learning outcomes across subjects such as science, history, and occupational training. The article explored the possibilities of using VR in the Pakistani learning environment, discussing its implementation in education. VR has the potential to enhance education in Pakistan despite the country's challenges, including infrastructure and teacher training. The aim was to motivate teachers and policymakers towards utilizing VR technology. Pakistan could develop more inclusive and effective learning environments by adopting VR in the future.

On the same note, Khalid et al. (2024) investigated the availability and perceptions of trainees towards simulation and augmented reality in postgraduate prosthodontic education in Pakistan: a cross-sectional study. This paper evaluated the accessibility of simulation-based learning (SBL) and AR/VR technologies to Prosthodontics postgraduate trainees in Pakistan and their perceptions of the effectiveness of these technologies. The respondents were 200 trainees, of whom 38% had access to SBL but only 24% underwent regular training. The centers never had AR technology. The respondents felt that SBL had the potential to reduce procedural risk and preferred it over conventional teaching methods. The research found that SBL varied greatly across provinces. It has been found that the use of AR/VR in Prosthodontics training is minimal, suggesting the need to integrate these technologies to increase training time.

Asad et al. (2024) also conducted a study on Virtual Reality-based Vestibule Training and Teaching Aid in the case of Virtual Reality in Pakistani Oil and Gas Industries: A Systematic Literature Review. This review discussed the health and safety challenges in the Pakistani oil and gas sector and examined the barriers to adopting VR-based training. It has examined 22 articles published between 2012 and 2022 and identified several challenges associated with the use of VR technology, including high costs, limited technological infrastructure, and the lack of specialized VR training modules in the oil and gas industry. This review also reported that few studies have been undertaken to use VR to address occupational health risks among oil and gas workers in Pakistan. It concluded that VR-based training may aid in risk mitigation and prevent deaths, and thus encouraged companies to evaluate its implementation and consider the existing gaps in the literature.

Lastly, Bashir et al. (2024) published the article "Innovative Approaches to Stress Reduction: A Review of Virtual Reality Therapy in University-Going Students." This paper examined how Virtual Reality Technology (VRT) can be effective in stress management among university learners and their readiness to embrace it rather than conventional practices. An existing body of literature was reviewed in a narrative that considered differences in VR content, delivery, and demographics. Findings indicated inconsistent success, with natural VR environments, in particular, greenery, being more effective than virtual settings in reducing stress. Some studies did not reveal a significant difference between VRT and conventional methods. Even though students were generally open to using VRT, its effect was mixed. The study found that VRT has potential, but further studies are needed to refine it for broader academic use. In these studies, VR consistently enhances engagement, motivation, and experiential learning. Nonetheless, the majority of Pakistani studies have been either discipline-based (medicine, prosthodontics, stress management) or sector-based (oil and gas). However, there is nothing in the literature that has addressed higher education in general. International studies offer a strong theoretical base but fail to foreground the realities of the developing world, where infrastructure, training, and access remain significant problems.

Although there is growing interest in VR at the global and national levels, empirical data on how Pakistani university students and faculty, regardless of discipline, perceive VR in higher education remains scarce. The present literature is bibliometric, sector-based, or small-scale. The gap this study fills

is providing quantitative evidence across a range of universities, highlighting the opportunities and obstacles to the use of VR in the higher education sector in Pakistan.

RESEARCH METHODOLOGY

This study employed a quantitative, cross-sectional survey design to investigate the role and impact of Virtual Reality (VR) in higher education in Pakistan. The design was guided by Constructivist theory and the Cognitive Theory of Multimedia Learning, ensuring that the instrument aligned with principles of experiential and multimodal learning.

Research Design

The research design used in this study is quantitative to examine the use and impacts of Virtual Reality (VR) in higher education. A survey style was chosen to allow for quantitative data collection and the identification of patterns and correlations across a broad group of participants. Constructivist theory and the Cognitive Theory of Multimedia Learning also influenced the design by ensuring that the instrument aligned with the theoretical assumptions of active multimedia learning and experiential multimodal learning.

Population and Sample

The study population comprised university teachers and students in both public and private institutions in Pakistan. To gain a wide-angle perspective, participants were selected from diverse fields. A simple random sampling method was used to select a sample of 130 respondents, with every member of the target population having an equal chance of being included.

Data Collection Tools

A structured questionnaire was used to collect data, containing both closed-ended and open-ended questions. The tool encompassed knowledge of VR technology, perceived advantages and challenges, its effects on student engagement and academic performance, and the readiness to incorporate VR into curricula. The questionnaire was initially piloted with a small sample of respondents to ensure clarity and reliability. Pilot feedback was incorporated to improve the final version.

Procedure

This process had three steps: a pilot study to test the tool; secondly, the questionnaire was distributed online and to the chosen Universities; and finally, data cleaning was performed to ensure accuracy and completeness. The participants were informed of the research's aim, and their confidentiality and voluntary participation were guaranteed in accordance with ethical research practices.

Data Analysis

To analyze the data, descriptive statistics were applied to the general responses and demographics, and frequency data were used to identify the most common opinions and experiences. Also, one-sample t-tests were performed to evaluate people's perceptions relative to expectations. The data analysis was performed using MS Word, MS Excel, and SPSS.

DATA ANALYSIS AND RESULTS

Table 1

Gender Distribution of Respondents

Gender					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Male	14	10.8	10.8	10.8
	Female	116	89.2	89.2	100.0
	Total	130	100.0	100.0	

The frequency table shows the gender distribution of the 130 participants in the study. Of the total sample, 14 participants (10.8%) are male, while 116 participants (89.2%) are female. The valid percentage confirms that 10.8% of the participants are male and 89.2% are female, with the cumulative percentage reaching 100%. This indicates that the sample is overwhelmingly female, with males accounting for a small proportion.

Table 2

Age Distribution of Respondents

Age					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	18-22	104	80.0	80.0	80.0
	23-26	21	16.2	16.2	96.2
	27-30	5	3.8	3.8	100.0
	Total	130	100.0	100.0	

The frequency table illustrates the age distribution of the 130 participants in the study. A majority of the participants, 104 individuals (80.0%), fall within the 18-22 age range. The 23-26 age group comprises 21 participants (16.2%), while the 27-30 age group comprises 5 participants (3.8%). The cumulative percentage reaches 100%, indicating that the sample encompasses participants from three distinct age groups. The data reveal that the most significant proportion of participants is in the 18-22 age range, followed by the 23-26 group, with a smaller number in the 27-30 group.

Table 3

Educational Qualifications of Respondents

Education					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	BS	124	95.4	95.4	95.4
	MPhil	2	1.5	1.5	96.9
	PhD	4	3.1	3.1	100.0
	Total	130	100.0	100.0	

The frequency table presents the educational qualifications of the 130 participants. A significant majority, 124 participants (95.4%), hold a Bachelor's degree (BS). Only 2 participants (1.5%) have completed their MPhil, while 4 participants (3.1%) have obtained a PhD. The cumulative percentage reaches 100%,

showing the complete distribution of educational backgrounds among the participants. The data show that the overwhelming majority of the sample holds a BS degree, with very few participants holding higher academic qualifications, such as an MPhil or PhD.

Table 4

Departmental Distribution of Respondents

Department					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Education	33	25.4	25.4	25.4
	Physics	5	3.8	3.8	29.2
	Microbiology	13	10.0	10.0	39.2
	Biotechnology	14	10.8	10.8	50.0
	Chemistry	13	10.0	10.0	60.0
	Computer Science	5	3.8	3.8	63.8
	Engineering	1	.8	.8	64.6
	Political Science	11	8.5	8.5	73.1
	Statistics	11	8.5	8.5	81.5
	International Relations	9	6.9	6.9	88.5
	Islamic Studies	6	4.6	4.6	93.1
	IT	2	1.5	1.5	94.6
	Urdu	7	5.4	5.4	100.0
	Total	130	100.0	100.0	

The frequency table provides an overview of the departments represented among the 130 participants in the study. The largest group, with 33 participants (25.4%), belongs to the Education department. Other departments include Physics (5 participants, 3.8%), Microbiology (13 participants, 10.0%), Biotechnology (14 participants, 10.8%), Chemistry (13 participants, 10.0%), and Computer Science (5 participants, 3.8%). Smaller groups come from Engineering (1 participant, 0.8%), Political Science (11 participants, 8.5%), Statistics (11 participants, 8.5%), International Relations (9 participants, 6.9%), Islamic Studies (6 participants, 4.6%), IT (2 participants, 1.5%), and Urdu (7 participants, 5.4%). The cumulative percentage reaches 100%, reflecting the diverse range of academic backgrounds in the sample. The data indicate that the sample is predominantly composed of participants from the Education department, with a smaller but varied representation from other disciplines.

Table 5

University-wise Distribution of Respondents

Institute					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Women University Multan	114	87.7	87.7	87.7
	Bahauddin Zakariya University	4	3.1	3.1	90.8
	Emerson University	12	9.2	9.2	100.0
	Total	130	100.0	100.0	

The frequency table shows the distribution of participants by institute. The majority of the participants, 114 individuals (87.7%), are from Women University Multan. A smaller group of 4 participants (3.1%) belong to Bahauddin Zakariya University, while 12 participants (9.2%) are from Emerson University. The cumulative percentage reaches 100%, showing the complete representation from these three institutions. The data reveal that Women University Multan has the highest participation in the study, with smaller contributions from the other two universities.

Table 6

Descriptive Statistics of Perceptions toward VR

Descriptive Statistics			
	N	**Mean**	**Std. Deviation**
I agree that "this virtual reality instructional system" is helpful for learning.	130	3.75	.817
The virtual environment scared me since I do not fully understand it.	130	3.24	.995
It was thought that the virtual evacuation training in VR would be helpful in a real situation as well.	130	3.65	.870
I think that my interest in courses and educational content would be higher if interactive content and VR systems were used.	130	3.63	.958
Time passes faster for me when I consume content via a VR system than on a regular 2D display.	130	3.60	.903
The visual stimuli provided by VR systems fascinate me.	130	3.64	.788
The virtual environment scared me since I do not fully understand it.	130	3.37	.958
I enjoyed the challenge of learning the virtual reality interaction devices (Oculus headset, gamepad, and/or keyboard).	130	3.58	.947
This virtual reality instructional system is helpful for learning.	130	3.75	.890
I felt that the real and virtual worlds were well integrated.	130	3.55	.872
Through VR simulations and experience, students will continue to explore and research the educational content.	130	3.71	.876
Using a VR system would distract students from the educational process.	130	3.39	1.008
The group's shared experiences in a shared environment are important in virtual reality.	130	3.77	.793
Stimulation of multiple senses enhances understanding of educational content in virtual reality.	130	3.68	.907
Introducing virtual reality into the classrooms turns learning into entertainment.	130	3.53	.908
Do you think VR helps you in your studies?	130	3.72	.847
I suffered from fatigue during my interaction with the virtual environment.	130	3.32	.958
Do you think VR can bring about a change in the way education is imparted at your university?	130	3.65	.852
Do you think VR can be used effectively in education?	130	3.62	.828
Do you have previous experience with VR?	130	1.66	.617

The descriptive statistics for the responses of 130 participants highlight their perceptions of virtual reality (VR) in education. The mean scores reflect generally positive views toward VR's usefulness in learning, with the highest mean of 3.77 for the statement "The group's shared experiences in a shared environment

are important in virtual reality," suggesting strong agreement among participants. Other responses, such as "This virtual reality instructional system is helpful to learning" (mean = 3.75) and "Due to the simulation and experience provided by VR, students will continue to explore and research the educational content" (mean = 3.71), also show that participants view VR as a beneficial educational tool.

However, some concerns are apparent, especially regarding the complexity and potential intimidating nature of VR. For instance, the statement "The virtual environment scared me since I do not fully understand it" has a mean of 3.24, indicating moderate apprehension. The statement "Using a VR system would distract students from the educational" also received a relatively lower mean of 3.39, suggesting some participants believe VR could be distracting. The mean for "I suffered from fatigue during my interaction with the virtual environment" (3.32) also indicates some discomfort during VR use.

Interestingly, participants generally felt that VR could significantly enhance their learning experience, with responses like "I think my interest in courses and educational content would be higher if interactive content and VR systems were used" (mean = 3.63), reflecting positive attitudes toward the potential engagement benefits of VR. Despite these positive views, the lowest mean was for the statement "Do you have previous experience with VR?" (mean = 1.66), indicating that a significant portion of participants had little to no prior VR experience.

The standard deviations suggest a relatively wide range of responses, with some items like "Using a VR system would distract students from the educational" (std. deviation = 1.008) showing greater variation in participants' opinions. In contrast, others, such as "Do you have previous experience with VR?" (std. deviation = 0.617), show greater consensus. Overall, the data demonstrates that while participants generally perceive VR as beneficial for education, there are concerns regarding its complexity, potential distractions, and the lack of prior experience among some users.

Table 7

One-Sample Statistics for Gender

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
Gender	130	1.89	.311	.027

The one-sample statistics for gender in the analysis show a mean of 1.89, a standard deviation of 0.311, and a standard error of the mean of 0.027, based on 130 participants. The mean of 1.89 suggests that most participants are likely female, as the gender scale might assign 1 to female and 2 to male. The standard deviation of 0.311 indicates a relatively low spread in responses, suggesting that the gender distribution in the sample is not highly diverse. The standard error of 0.027 reflects the precision of the sample mean, showing that the mean is estimated with relatively high accuracy. Overall, the analysis provides insight into the sample's gender composition, with minimal variation.

Table 8

One-Sample t-Test for Gender

One-Sample Test						
	Test Value = 0					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Gender	69.333	129	.000	1.892	1.84	1.95

The results of the one-sample t-test for gender indicate that the test statistic (t) is 69.333 and the degrees of freedom (df) are 129. The significance value (p-value) is reported as 0.000, which is well below the commonly used threshold of 0.05. This suggests that the difference between the sample mean (1.89) and the hypothesized population mean (0) is statistically significant. The mean difference is 1.892, with a 95% confidence interval ranging from 1.84 to 1.95. This means that the actual population mean gender in the sample is likely to fall between 1.84 and 1.95, further reinforcing the conclusion that the sample is predominantly female, since the gender coding likely assigns 1 to female and 2 to male. Overall, the test indicates a clear, statistically significant difference from the hypothesized value, confirming that the sample's gender distribution is significantly skewed toward females.

DISCUSSION

The results of the present research indicate that students and faculty at Pakistani universities are generally optimistic about VR as an educational resource, believing it can improve engagement, interactivity, and knowledge retention. This aligns with the tenets of Constructivist theory (Piaget, 1972; Vygotsky, 1978), which emphasize active and experiential learning, and with the Cognitive Theory of Multimedia Learning proposed by Mayer (2005), which emphasizes multimodal instruction. The respondents shared the view that VR would make the learning process more interactive and immersive, aligning with the idea that technology can engage multiple senses and foster a deeper understanding.

These findings were reported by Danish et al. (2018), who found that integrating AR with conventional teaching enhanced learning performance, especially in technical courses. Likewise, Sattar et al. (2019) showed that VR was a significant motivator and competency builder for medical students, compared with text- and video-based approaches. These results are further extended to the broader higher education setting in Pakistan, where VR is perceived as helpful not only in specialized domains such as medicine but also across a wide range of contexts, including education, biotechnology, and political science.

Meanwhile, participants also reported feeling intimidated, tired, and distracted during VR use. This is consistent with the conflicting results reported by Bashir et al. (2024), who found that VR therapy reduced stress among students. In contrast, others did not see the same effect with conventional therapy. The fear observed in this study can be explained by a lack of prior exposure, as most respondents lacked hands-on experience with VR technology. This observation indicates the need for training and familiarization, as noted by Khalid et al. (2024) in their investigation of prosthodontics trainees, in which access was limited and uneven, thereby preventing its successful adoption.

Its findings also align with those of Farooqui et al. (2023), who highlighted the potential of VR to be transformative in Pakistan but noted that it lacked infrastructure and teacher readiness. On the same note, high costs and uncustomized modules pose a significant obstacle in the oil and gas industry, as Asad et al. (2024) find, a constraint that parallels the constraints on infrastructure and finances in universities. These issues indicate that, even though people are eager for VR, there are systemic obstacles to integrating it sustainably.

Strangely enough, the highest mean score for shared experiences as an essential part of a virtual environment indicates the social aspect of learning and aligns with Asad et al. (2021), which emphasizes the use of VR to improve communication and collaborative learning. It suggests that VR may be beneficial for supporting peer interaction and group-based learning in Pakistani classrooms, as overcrowding and limited resources often limit active learning.

Generally, the research adds to the body of literature by presenting empirical data of the higher education sector in Pakistan, which is poorly represented in the world of VR research. Although trends in international publishing have been mapped (Rashid et al., 2021), developing countries are often absent

from these studies. This study bridges that gap by demonstrating that Pakistani students and teachers are open to VR, though successful adoption will require policy support, investment, and capacity building.

CONCLUSION

This study explored the role and impact of Virtual Reality (VR) in university-level education in Pakistan. By analyzing the perceptions of university educators and students, the research aimed to assess the potential benefits and challenges of VR in enhancing the educational experience. The data collected through a questionnaire provided valuable insights into how VR could improve learning environments, engagement, and educational outcomes.

The descriptive statistics and one-sample t-test revealed that participants generally had a positive perception of VR as a learning tool. The results indicated strong agreement with statements suggesting that VR could enhance student interest in courses, improve the learning experience, and facilitate continued exploration of educational content. Participants also expressed that VR could lead to more immersive and interactive learning environments, stimulating multiple senses and fostering more profound understanding.

Despite the positive perceptions, some challenges were also identified. Participants indicated that the virtual environment could be intimidating, particularly for those with little prior VR experience. However, this was balanced by the acknowledgment that, with proper exposure and training, these concerns could be overcome. The study also showed that VR's potential to transform education at the university level in Pakistan is recognized, with participants believing that VR could bring about significant changes in teaching methodologies.

The research highlighted that while VR is seen as a promising tool, universities need to invest in better infrastructure, training programs, and accessible VR resources. Many participants reported limited prior experience with VR, suggesting that, for VR to be effectively integrated into education, universities should focus on familiarizing educators and students with the technology.

In conclusion, this study demonstrates that VR holds significant potential to revolutionize higher education in Pakistan by offering more engaging, interactive, and immersive learning experiences. However, successful implementation requires addressing challenges such as accessibility, user comfort, and training. Future research could explore the long-term impact of VR on academic performance and its effectiveness across various academic disciplines.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations are proposed for the effective integration of Virtual Reality (VR) in higher education in Pakistan:

- As a significant number of respondents said that they had little previous exposure to VR, and some were intimidated by it, universities should consider holding introduction training sessions and practice activities in VR at the institutional level, with students and faculty. It will help reduce fear and build trust in VR use.
- The respondents were quite sure that VR increases engagement and interactivity. Hence, it is recommended that universities start with pilot projects in other fields, such as Education, Biotechnology, and Political Science, where the sample was highly representative, and then proceed to the others.
- The paper raised issues regarding access and resources. The institutes are supposed to invest in VR labs and standard facilities where students across departments can access the technology without cost limitations.

- As the participants thought that through VR, one could engage more in terms of interaction and entertainment in the learning process, curriculum designers ought to incorporate VR modules in the current course, especially in science and engineering, where simulations can substitute the expensive physical laboratories.
- Other respondents experienced distraction and fatigue when using VR. To this end, universities ought to implement balanced policies that restrict VR sessions to appropriate times and frequencies and use them alongside traditional approaches.
- Since the sample was skewed in favor of females, any future VR projects must have equal access to all genders and institutions, such as rural universities, to prevent the further increase of the digital divide.

IMPLICATIONS OF THE RESEARCH

- **Theoretical Implications**: The research supports the Constructivist learning theory in that VR facilitates active, experiential, and collaborative learning. It also supports the Cognitive Theory of Multimedia Learning, as VR engages multiple sensory channels, thereby improving retention and comprehension. The study extrapolates existing theories to emerging educational settings by applying the results to a developing country context.
- **Practical Implications:** In the case of universities, the findings reveal that institutions should invest in infrastructure and training to render the use of VR a possibility. For teachers, the results indicate that VR can enhance student engagement and motivation, particularly in classrooms with limited resources. To policymakers, the research offers evidence that VR can help close the gap in access to quality education, provided that equity and inclusion are prioritized.

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