

AWARENESS, KNOWLEDGE, AND ATTITUDE TOWARDS VIRTUAL AND AUGMENTED REALITY TECHNOLOGIES IN PHYSIOTHERAPY PRACTICE AMONG FINAL YEAR PHYSIOTHERAPY STUDENT AT A SUBSAHARAN AFRICAN UNIVERSITY

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ABSTRACT

Background: Technological innovations such as virtual reality (VR) and augmented reality (AR) are transforming healthcare education and clinical practice. These immersive technologies offer opportunities for interactive, experiential learning and can enhance rehabilitation outcomes. However, the extent to which physiotherapy students are aware of, knowledgeable about, and have a positive attitude toward VR/AR remains underexplored, especially in resource-limited settings like Nigeria.

Aim: To assess the awareness, knowledge, and attitudes of final-year physiotherapy students toward the application of VR and AR in physiotherapy practice across selected Nigerian institutions.

Materials and methods: A descriptive cross-sectional study was conducted among 400 final-year physiotherapy students from five Nigerian universities using a self-structured, validated online questionnaire. The tool assessed participants' demographic details, familiarity with VR/AR, practical knowledge, and attitudes. Data was summarized using descriptive statistics and visual representations.

Results: While 74.2% of students were aware of VR/AR applications in physiotherapy, only 1.8% had good knowledge, and just 1.0% had practical experience using VR/AR. However, 62.4% strongly agreed that VR/AR should be integrated into physiotherapy practice, and 58.8% expressed high interest in learning more. Major barriers identified included lack of exposure in the curriculum, insufficient equipment, and inadequate instructor training.

Conclusion: Although final-year physiotherapy students in Nigeria showed high awareness and interest in VR/AR, practical knowledge and experience remain low. The findings support the urgent need to integrate VR/AR into physiotherapy curricula through hands-on training, workshops, and institutional investment to prepare future practitioners for technology-enhanced rehabilitation.

Keywords: Virtual reality, Augmented reality, Physiotherapy students, Rehabilitation, Nigeria, Health Technology Education

INTRODUCTION

Virtual reality (VR) is a simulated 3D environment that enables users to explore and interact with virtual surroundings that approximate reality, as it is perceived through the users' senses.^{1,2} Augmented reality (AR) is an enhanced version of the real world, achieved through computer-

generated digital information.³ AR integrates digital information with the user's environment in real time.⁴ While VR and AR are designed to simulate an environment, each concept is unique and involves different use cases.⁵ VR provides a fully immersive digital experience for the viewer, while AR allows more freedom as it enhances the real world rather than replacing

it. Virtual reality originated in 1838 with Charles Wheatstone's stereoscope, which used an image for each eye to create a 3D image, and this technology has grown and become more incorporated into our everyday lives.⁶ In 1968, Ivan Sutherland introduced the world to the first head-mounted AR display, *The Sword of Damocles*, which laid the foundation for VR.⁷ Over the decades, technological advancements have accelerated the development of VR. In the 1980s and 1990s, companies like Sega and Nintendo developed VR gaming systems, with limited success; however, it was not until the 2010s that companies like Oculus and HTC Vive introduced high-quality VR headsets that leveraged powerful graphics and motion-tracking technology.⁷ Virtual reality (VR) and AR have been used in gaming, entertainment, fashion, and health. In healthcare, the rise of AR and VR is forever changing the way health professionals treat and care for their patients.⁸ VR and AR aid in accurate diagnoses, personalized treatment planning, patient education, and demystifying complex medical information.⁹

In physiotherapy, recent advancements in VR have opened life-changing possibilities in rehabilitation.¹⁰ VR and AR technologies provide new experiences to users during rehabilitation, increasing engagement for improved physical outcomes. VR can be used for different purposes in exercise therapy, including pain management, improved functional ability, increased range of motion, increased muscular strength, and increased motivation. For stroke survivors, VR incorporates several theories of neuroscience and motor learning,¹¹ while

AR provides real-time feedback and guidance with visual cues, instructions, or corrections.

Integrating AR and VR into treadmill training is an emerging rehabilitation tool, used to improve gait and balance in stroke survivors.¹¹ Moreover, it can help increase adherence and retention by enabling patients to track their progress, set goals, and receive reminders or notifications. VR systems optimize motor learning in a safe environment and can help improve activities of daily living by replicating real-life scenarios. Within VR, augmented feedback about a person with Parkinson's performance enables repetitive practice of motor tasks, thus stimulating both motor and cognitive processes simultaneously.

Despite the burgeoning interest in VR and AR, there is a lack of comprehensive studies focusing on final-year students' perspectives on these technologies. Therefore, this study aimed to assess awareness, knowledge, and attitude about VR and AR among final-year physiotherapy students.

MATERIALS AND METHODS

Research Design and population

This was a cross-sectional descriptive study involving four hundred final-year physiotherapy students from Nnamdi Azikiwe University, University of Nigeria Nsukka, University of Benin, University of Maiduguri, and University of Ilorin who were recruited via purposive sampling. The participants included male and female

physiotherapy students in their final year of the selected institutions only.

Research instrument

Data were collected using a self-structured questionnaire designed to assess awareness, knowledge, and attitude about VR and AR among final-year physiotherapy students. The questionnaire was developed based on existing literature and validated through a pilot study.

Data collection

Ethical approval was sought and obtained from the Ethical Review Committee of Faculty of Health Sciences and Technology Nnamdi Azikiwe University, Nnewi. Data were collected through a structured, self-administered questionnaire designed to evaluate the awareness, knowledge, and attitude of final-year physiotherapy students towards VR and AR technologies in physiotherapy practice. The questionnaire was created based on existing literature and validated through a pilot study to ensure clarity and relevance. The questionnaire consisted of four sections: demographic information, awareness of VR/AR, knowledge of VR/AR applications, and attitude towards using these technologies clinically. The questionnaire was distributed online using google forms. The link to the questionnaire was sent to participants through different social media platforms. The purpose of the study was explained to the participants, and informed consent was obtained before administering the

questionnaire. Participation was voluntary, and confidentiality and anonymity of responses were assured.

Data Analysis

Descriptive statistics were used to summarize participants' demographic characteristics, level of awareness, level of knowledge, and attitude towards VR and AR. Pie chart and bar chart will be used for visual representations of data. Frequencies and percentages were used to present categorical variables such as gender, age group, institution, awareness of VR/AR, and responses to knowledge and attitude questions, Mean and standard deviation were used for continuous variables.

RESULTS

Socio-demographic characteristics of the participants

A total of 400 final-year physiotherapy students participated in the study. The gender distribution was nearly equal, with 201 (50.2%) males and 199 (49.8%) females. Regarding age, most respondents, 313 students (78.3%), were between 18 and 25 years, followed by 83 students (20.8%) aged 26–35 years, and only 4 students (1.0%) aged 36–45 years.

Awareness of VR/AR

Figure 1 illustrates the participants' familiarity with VR/AR. A moderate proportion of students (50.40%) reported being familiar with the concepts of VR and

AR, while a smaller percentage were either unfamiliar (34.80%) or very familiar (14.80%). Regarding curricular exposure, 91% of the students indicated they had not been previously exposed to VR/AR through their coursework (Figure 2).

Knowledge of VR/AR in physiotherapy practice

Table 2 presents participants' responses to knowledge-based questions on VR/AR. While 74.2% of students knew that VR and AR have applications in physiotherapy practice, only 1.0% had previously used any VR/AR device or software. Figure 3 shows what participants most commonly associate VR/AR with, with education (63%) and gaming (25.80%) being the highest. Despite high awareness of potential applications, 64% of students had poor knowledge of VR/AR in practice, 28.7% had fair knowledge, 5.5% had no knowledge, and only 1.8% demonstrated good knowledge (Figure 4). Students reported needing access to training workshops, equipment, and

practical demonstrations to feel competent in using VR/AR technology (Figure 5).

Attitude towards VR/AR in physiotherapy

Attitude-based responses, summarized in Table 3 and Figures 6 and 7, revealed that 58.8% of participants were very interested in learning about VR/AR, 37.5% were somewhat interested, and only 3.8% were not. Regarding opinions on integrating VR/AR into physiotherapy, 62.4% strongly agreed it should be integrated into education and practice, 53.8% agreed that VR/AR would improve patient outcomes, and 58.8% believed it would make treatment more engaging for patients.

Participants also identified cost, lack of equipment, and insufficient training opportunities as major challenges to implementing VR/AR in clinical settings (Figure 6). Nevertheless, many expressed a willingness to participate in future training or workshops to enhance their skills (Figure 7).

Table 1. Sociodemographic characteristics of the participants

Variable	Class	Frequency	Percentage (%)
Gender	Male	201	50.2
	Female	199	49.8
Age	18–25 years	313	78.3
	26–35 years	83	20.8
	36–45 years	4	1.0
Institution	University of Benin	11	9.9
	University of Ilorin	3	2.7
	University of Maiduguri	12	10.8
	University of Nigeria Nsukka	21	18.9
	Nnamdi Azikiwe University	64	57.7

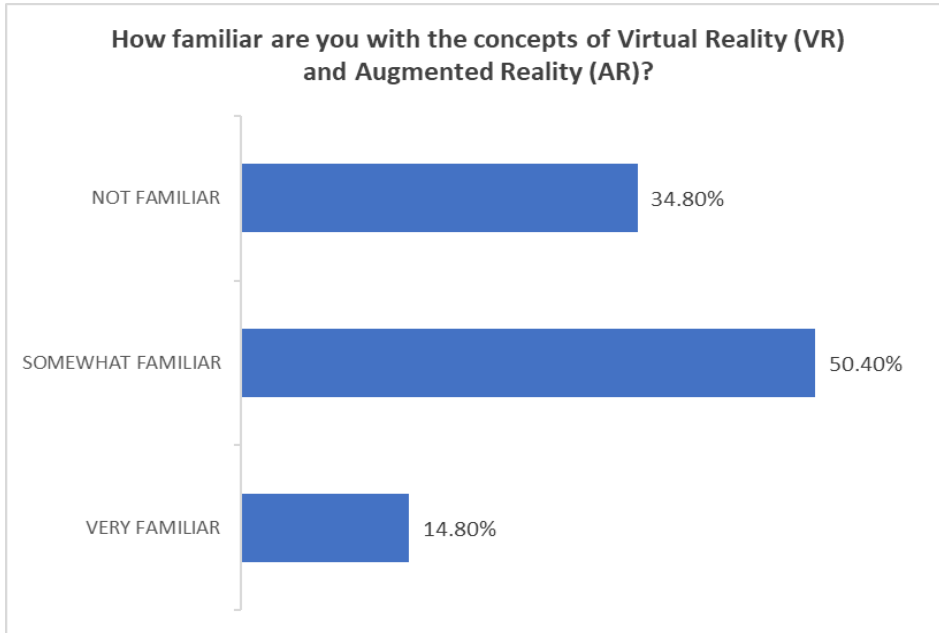


Figure 1. Familiarity of participants with the concepts of virtual and augmented realities

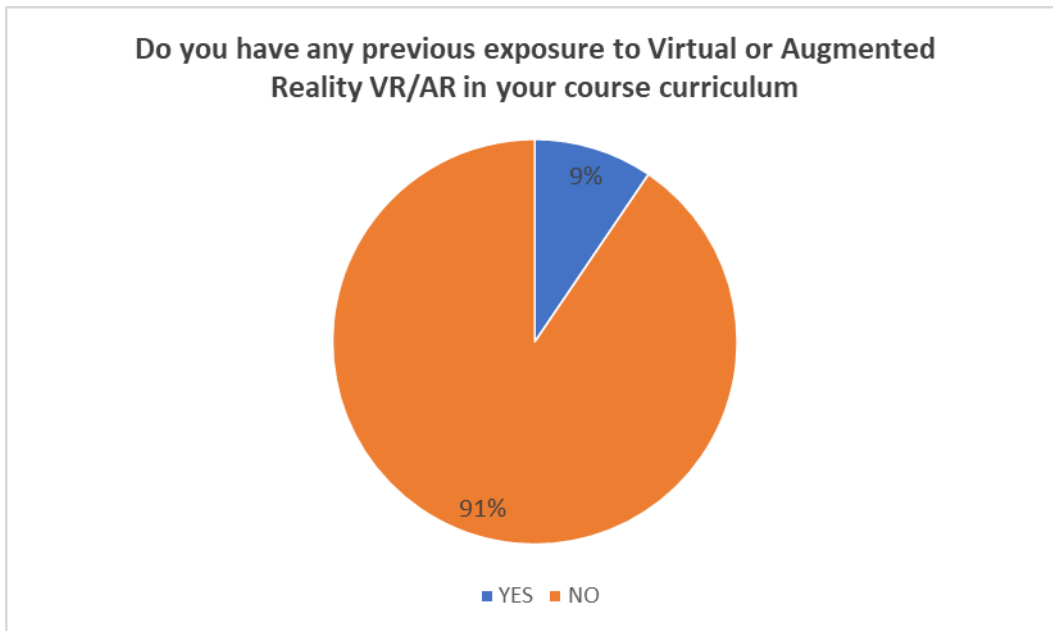


Figure 2. Previous exposure to virtual/augmented reality in the physiotherapy curriculum

Table 2. Knowledge of VR and AR in physiotherapy practice

Items	Yes (n)	%	No (n)	%
Have you used any VR and AR device or software in the past?	4	1.0	395	99.0
Are you aware of the use of VR/AR technology in physiotherapy treatment?	296	74.2	103	25.8
What areas of physiotherapy do you think can benefit from VR/AR technology? - Musculoskeletal Rehabilitation	331	82.8	69	17.3
What areas of physiotherapy do you think can benefit from VR/AR technology? - Neurological Rehabilitation	334	83.5	66	16.5
What areas of physiotherapy do you think can benefit from VR/AR technology? Cardiorespiratory rehabilitation	329	82.3	71	17.8
What areas of physiotherapy do you think can benefit from VR/AR technology? Pediatrics	287	71.9	112	28.1
What areas of physiotherapy do you think can benefit from VR/AR technology? Orthopedics	373	82.2	81	17.8
What areas of physiotherapy do you think can benefit from VR/AR technology? Others	266	66.7	133	33.3

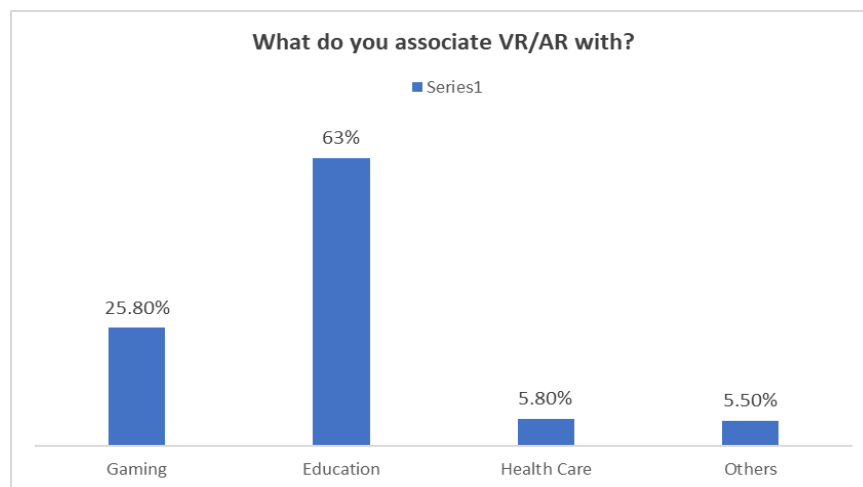


Figure 3. Participants’ level of knowledge regarding VR/AR applications in physiotherapy practice

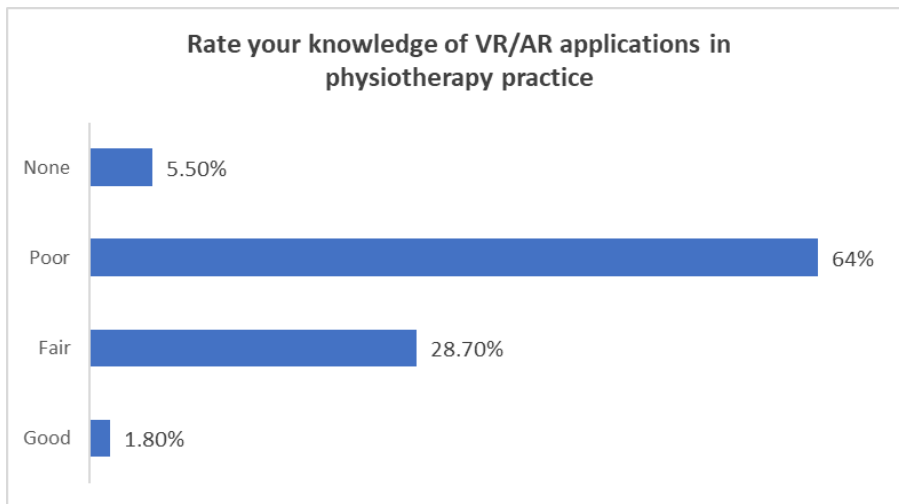


Figure 4. Self-Rated Knowledge of VR/AR Applications in Physiotherapy

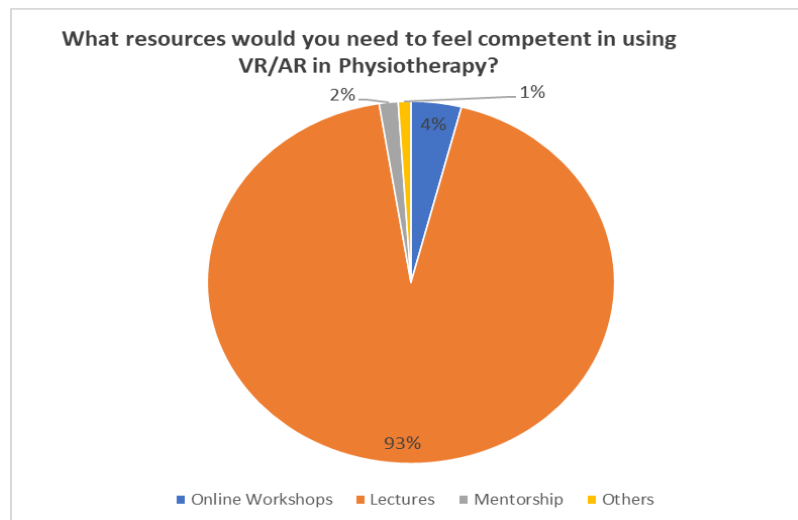


Figure 5. Resources needed by participants to feel competent in using VR/AR in physiotherapy

Table 3. Attitude towards VR and AR in physiotherapy practice

Items	Very Interested (n)	%	Somewhat interested (n)	%	Not Interested (n)	%
How interested are you in learning about VR/AR for physiotherapy?	235	58.8	150	37.5	15	3.8
Do you think the inclusion of VR/AR in physiotherapy practice will improve patient outcomes?	Strongly Agree (n) 97	% 24.9	Agree (n) 215	% 53.8	Neutral (n) 88	% 22.0
Do you think the use of VR/AR in physiotherapy will make treatment more engaging for patients?	101	25.3	235	58.8	64	16.0
Do you believe VR/AR should be integrated into physiotherapy education and practice?	105	26.3	249	62.4	45	11.3

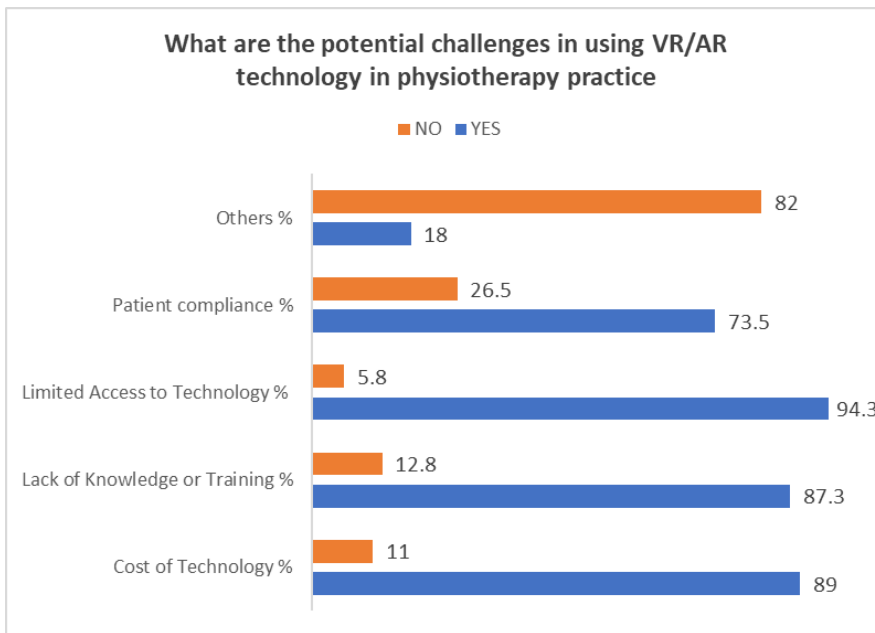


Figure 6. Perceived Challenges in Using VR/AR Technology in Physiotherapy Practice

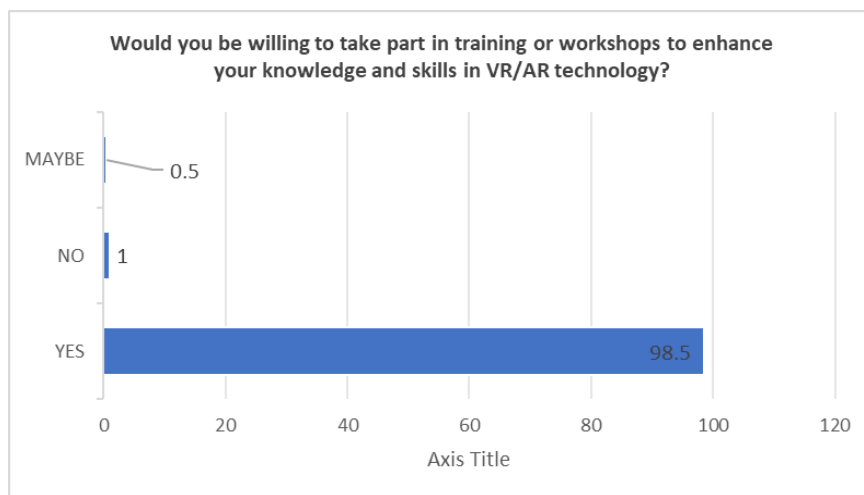


Figure 7. Willingness of participants to participate in vr/ar training or workshops

DISCUSSION

This study aimed to assess the awareness, knowledge, and attitudes of final-year physiotherapy students towards VR and AR technologies in physiotherapy practice. With a healthcare industry striving to incorporate technology to improve clinical outcomes and education, it is important that physiotherapy students, future healthcare professionals, are well equipped to comprehend, assess, and utilize such tools in practice. The results of this study will provide useful information on the ability of students in institutions in Nigeria to adopt these innovations.

The results revealed that many participants were aware that they can use VR and AR in physiotherapy practice. This implies that students are not totally unknown to immersive technologies as there is an increasing world presence through media, gaming, or informal teaching. The high level of awareness corresponds with the report of a study that VR/AR has been recognized more among medical students and trainees owing to their massive discussions in healthcare innovations.¹²

However, this study also showed that a few of the participants had ever used VR or AR tools, and most of them had poor knowledge of their use in physiotherapy. This disparity has been emphasized in studies as a general challenge to incorporating emerging technologies into health education.^{13,14} Many institutions, particularly in low-resource contexts, do not have the infrastructure or expertise to expose students to such advanced technological systems.

The participants illustrated the broad utility of VR/AR into multiple specialties in physiotherapy, which include musculoskeletal, neurological, cardiorespiratory, pediatrics, and orthopedics. These responses reflect a conceptual awareness of the clinical potential of VR/AR, which is reinforced by research highlighting that VR/AR are used in post-stroke rehabilitation, for chronic pain management, balance training, gait retraining, pediatric motor therapy.^{15,16} VR-based therapy can significantly improve range of motion and pain in patients after total knee arthroplasty, confirming student perceptions in this study.¹⁷

However, the participants' reported lack of practical knowledge may restrict their utilization of such tools effectively, highlighting the importance of structured exposure and simulation-based learning in undergraduate training.^{18,19}

Positive attitudes towards VR/AR integration into physiotherapy were demonstrated in the study. Most participants reported a high level of interest in learning about VR/AR, and VR/AR should be incorporated into physiotherapy education and as part of physiotherapy practice. Additionally, most agreed that VR/AR would help to better patient outcome and make treatment more engaging for patients. This indicates student willingness to accept innovation if there is enough support and training given. Analogous attitudes were found in a study where physiotherapists considered VR to be a promising addition to rehabilitation in increasing motivation and compliance of the patients.²⁰ Most

participants indicated a willingness to participate in VR/AR-related training and workshops, suggesting that while current knowledge levels are low, students are motivated to learn if given the opportunity. Two studies highlighted the importance of learner-centered approaches and interactive environments in improving VR/AR adoption in rehabilitation education.^{21,22}

The participants also identified several barriers to the effective use of VR and AR in physiotherapy practice, including lack of access to VR/AR hardware and software, limited inclusion of technology in current curriculum, inadequate instructor training, and financial constraints. These challenges reflect similar dominant issues experienced globally, in developing nations, where lack of resources has been responsible for limited progress in adopting technological solutions in education.^{23,24} In addition, cost implications related to the acquisition and maintenance of VR/AR infrastructure are high and a great challenge to institutions that are already faced with teaching resource challenge.

Apart from financial challenges, another great challenge is the shortage of trained faculty and standardized set of teaching modules. Faculty development programs are essential to developing institutional capacity and an instructor's readiness to teach the theoretical and practical aspects of VR/AR use.¹⁴ It is imperative to modify Nigerians physiotherapy programs by incorporating curriculum to learn about digital rehabilitation tools, which include VR and AR. This inclusion instead of theoretical foundations should contain also practical

exposure, by means of cooperation with providers of technology, simulation labs, or inter-university cooperation.

Furthermore, integrating VR/AR into physiotherapy education aligns with a broader trend in healthcare education towards experiential learning methodologies, where students conduct interactive scenario-based activities that mimic real-life situations.²⁵ These technologies have shown promise in surgical training, pain management, cognitive rehabilitation, and neurorehabilitation.^{26,27}

This study had some limitations. This study's reliance on self-reported data may be subject to response bias, as participants might have overestimated or underestimated their awareness, knowledge, or attitudes towards VR and AR technologies. Additionally, the study utilized an online questionnaire distributed via social media, which may have excluded students with limited internet access, potentially affecting the representativeness of the sample. The study was also limited to final-year physiotherapy students in five selected Nigerian universities, restricting the generalizability of the findings to students in other institutions or disciplines. Furthermore, the cross-sectional design provides a snapshot of perceptions at a single point in time, without accounting for changes in knowledge or attitudes that may occur with increased exposure or curriculum updates. Finally, the study did not explore potential differences in responses based on demographic variables such as gender or prior exposure to technology, which could have offered more nuanced insights.

CONCLUSION

This study examined the awareness, knowledge, and attitudes of final-year physiotherapy students in selected Nigerian universities toward using VR and AR in physiotherapy practice. The findings revealed that while most students were aware of the existence and potential applications of VR and AR in rehabilitation, only a small proportion possessed adequate knowledge or had practical experience with these tools. Despite these knowledge gaps, students demonstrated a strong interest in learning about VR/AR and a positive attitude toward integrating these technologies into physiotherapy education and clinical practice.

The results highlight a clear need to incorporate modern digital tools like VR and AR into physiotherapy curricula through structured training, simulations, and workshops. Doing so will not only improve students' competence but also prepare them to meet the evolving demands of technology-driven healthcare. Bridging the gap between awareness and practical application is essential to equipping future physiotherapists with the skills required to deliver innovative and effective patient care in an increasingly digital world.

Competing interests

The authors declare no competing interests.

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