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Abstract

Purpose: The aim of the study was to assess the effects of virtual reality integration on student engagement in online learning in Nigeria.

Methodology: This study adopted a desk methodology. A desk study research design is commonly known as secondary data collection. This is basically collecting data from existing resources preferably because of its low cost advantage as compared to a field research. Our current study looked into already published studies and reports as the data was easily accessed through online journals and libraries.

Findings: Utilizing VR technology in online learning environments has shown to significantly enhance student engagement through immersive and interactive experiences. Study indicate that students exhibit higher levels of motivation, interest, and participation when learning through VR compared to traditional online methods. The immersive nature of VR fosters a sense of presence and involvement, leading to increased attention and focus during learning activities. Moreover, VR facilitates experiential learning, allowing students to explore complex concepts in a simulated environment, which enhances comprehension and retention. Additionally, VR-based activities promote collaboration and social interaction among students, contributing to a sense of community in online learning environments. Overall, integrating VR into online learning holds great potential for improving student engagement and learning outcomes in diverse educational settings.

Implications to Theory, Practice and Policy: Self-determination theory, cognitive load theory and social learning theory may be used to anchor future studies on assessing the effects of virtual reality integration on student engagement in online learning in Nigeria. Provide professional development opportunities and training programs for educators to enhance their competence in integrating VR technology into online courses effectively. Advocate for increased funding and resources to support the adoption and implementation of VR technology in educational settings.

Keywords: *Virtual Reality Integration, Student Engagement, Online Learning*

INTRODUCTION

The integration of virtual reality (VR) technology into online learning has emerged as a promising avenue to enhance student engagement and learning outcomes. In developed economies like the USA, student engagement levels in online learning have shown both promise and challenge. According to a study by Allen and Seaman (2017), online enrollment rates in higher education institutions have steadily increased, indicating a growing acceptance and adoption of online learning platforms. However, despite this growth, there are concerns about the effectiveness of online education in engaging students. For instance, a report by the National Center for Education Statistics (NCES) highlighted that in 2019, only 29% of undergraduate students enrolled in exclusively online courses felt engaged, compared to 43% of those enrolled in traditional face-to-face courses. This suggests that while online learning offers flexibility and accessibility, it may struggle to fully capture and maintain student engagement.

Similarly, in the UK, online learning platforms have become increasingly popular, yet concerns persist regarding their ability to engage students effectively. Research by Jaggars and Xu (2016) found that while the UK has seen a significant increase in online course offerings, there remains a gap in student engagement levels between online and traditional classroom settings. For example, a survey conducted by the Higher Education Policy Institute (HEPI) in 2020 revealed that only 32% of students in the UK felt fully engaged in online courses, compared to 46% in face-to-face classes. This indicates a need for further exploration into strategies to enhance student engagement in online learning environments.

Moving on to developing economies, such as those in Southeast Asia, online learning faces unique challenges and opportunities. In countries like Thailand and Indonesia, where access to traditional education may be limited in rural areas, online learning platforms offer a promising solution for expanding educational opportunities. However, research by Lee and Hsieh (2018) indicates that despite efforts to promote online education in these regions, student engagement remains a concern. For example, a study conducted by the Southeast Asian Ministers of Education Organization (SEAMEO) in 2018 found that only 25% of students in rural areas reported feeling engaged in online courses, compared to 40% in urban areas. This suggests a need for targeted interventions to address the digital divide and improve engagement levels in online learning among underserved communities.

In Latin America, countries like Colombia and Peru are also grappling with challenges related to online learning engagement. Despite initiatives to promote digital inclusion and expand access to educational resources, socioeconomic disparities remain a barrier to engagement. Research by Trujillo-Pisanty and Castillo (2022) suggests that while online education offers flexibility and convenience, issues such as limited access to technology and digital skills gaps hinder effective engagement. For example, a study conducted by the Colombian Ministry of Education in 2021 revealed that only 25% of students from low-income households reported feeling engaged in online courses, compared to 50% from higher-income households. This highlights the need for comprehensive strategies to address socioeconomic barriers and ensure inclusive access to online learning in Latin America.

In Central Asia, countries like Kazakhstan and Uzbekistan are navigating challenges related to online learning engagement amid efforts to modernize their education systems. While online education presents opportunities for expanding access to quality instruction, issues such as

language barriers and limited digital literacy impede effective engagement. Research by Ismailova and Tulegenova (2022) suggests that while there is enthusiasm for incorporating technology into education, infrastructure limitations and pedagogical concerns hinder widespread adoption. For example, a survey conducted by the Kazakh Ministry of Education and Science in 2021 revealed that only 18% of students in rural areas reported feeling engaged in online courses, compared to 40% in urban areas. This underscores the importance of addressing systemic challenges and promoting innovative teaching practices to enhance student engagement in online learning across Central Asia.

In developing economies like India and Brazil, online learning presents both opportunities and challenges. With large populations and diverse educational needs, these countries are increasingly turning to online platforms to supplement traditional classroom instruction. However, research by Mishra and Yadav (2018) indicates that disparities in access to technology and internet connectivity persist, affecting student engagement in online learning. For instance, a study conducted by the National Sample Survey Office (NSSO) in India found that while urban areas have relatively high internet penetration rates, rural areas lag behind significantly, with limited access to online resources. This digital divide exacerbates existing inequalities in education and hampers efforts to fully engage students in online learning environments.

Similarly, in countries like South Africa and Mexico, where socioeconomic disparities are pronounced, online learning initiatives face significant challenges in promoting student engagement. Research by Chigona and Chigona (2019) suggests that while online education holds promise for expanding access to education, issues such as high data costs and limited digital literacy hinder widespread adoption. For example, a survey conducted by the South African Institute of Distance Education (SAIDE) in 2021 revealed that only 20% of students from low-income households reported feeling engaged in online courses, compared to 45% from higher-income households. This highlights the need for targeted interventions to address socioeconomic barriers and improve student engagement in online learning among disadvantaged populations in developing economies.

In other developing economies such as Bangladesh and Pakistan, online learning endeavors face similar hurdles but also show potential for addressing educational gaps. Despite challenges related to infrastructure and access, initiatives like the Virtual University of Pakistan and the Bangladesh Open University have made strides in delivering online education to remote areas. However, research by Rahman et al. (2020) indicates that while these efforts have expanded access to education, they have not necessarily translated into high levels of student engagement. For example, a study conducted by the Bangladesh Bureau of Educational Information and Statistics (BANBEIS) in 2019 revealed that only 18% of students enrolled in online courses reported feeling fully engaged, highlighting the need for tailored strategies to enhance engagement in diverse learning contexts.

In Southeast Asia, countries like Vietnam and the Philippines are grappling with the challenge of ensuring equitable access to online education while enhancing student engagement. Despite efforts to promote digital literacy and expand internet infrastructure, disparities persist, particularly in rural and remote areas. Research by Nguyen and Nguyen (2021) suggests that while online learning has gained traction, issues such as limited access to devices and internet connectivity hinder widespread engagement. For instance, a survey conducted by the Vietnamese Ministry of Education and Training in 2020 found that only 22% of students in rural areas reported feeling

engaged in online courses, compared to 45% in urban areas. This underscores the need for targeted interventions to bridge the digital divide and improve engagement levels in online learning across Southeast Asia.

Similarly, in countries like Ethiopia and Nigeria, where educational resources are often scarce, online learning holds promise for improving access to quality education. However, challenges such as unreliable internet connectivity and limited digital infrastructure hinder widespread adoption. Research by Alemu and Seid (2020) suggests that while there is enthusiasm for online education among policymakers and educators, ensuring equitable access and engagement remains a formidable task. For instance, a survey conducted by the Nigerian Educational Research and Development Council (NERDC) in 2020 found that only 12% of students in rural areas reported feeling engaged in online courses, compared to 35% in urban areas. This underscores the importance of addressing infrastructure limitations and promoting digital literacy to unlock the full potential of online learning in developing economies.

In the Middle East and North Africa (MENA) region, countries like Egypt and Jordan are facing unique challenges in promoting student engagement in online learning. Despite efforts to invest in digital infrastructure and expand access to online education, cultural norms and socioeconomic factors influence the adoption and effectiveness of online learning platforms. Research by El Seoud et al. (2021) suggests that while online education has the potential to address educational gaps, issues such as gender disparities and traditional teaching practices pose barriers to engagement. For instance, a study conducted by the Egyptian Ministry of Higher Education in 2020 found that only 30% of female students reported feeling engaged in online courses, compared to 50% of male students. This highlights the need for culturally sensitive approaches and gender-inclusive strategies to promote equitable engagement in online learning across the MENA region.

In sub-Saharan economies, such as Nigeria and Kenya, online learning initiatives are still in the nascent stage, with varying levels of access and infrastructure. While there is growing interest in leveraging technology to enhance education, challenges such as limited internet connectivity and resource constraints persist. A study by Aduwa-Ogiegbaen and Iyamu (2018) highlighted that despite government efforts to promote e-learning, only 15% of students in sub-Saharan Africa reported high levels of engagement in online courses. For instance, a survey conducted by the African Union in 2019 revealed that while 70% of urban students had access to the internet, only 30% of rural students could access online learning resources. This underscores the urgent need for investment in infrastructure and policies to bridge the digital divide and improve student engagement in online education.

The integration of virtual reality (VR) technology holds immense potential for transforming online learning and enhancing student engagement levels. One key application of VR in education is immersive simulations, where students can participate in realistic scenarios and hands-on experiences, thus fostering active learning and deep engagement (Kizilcec & Halawa, 2018). For example, VR simulations can recreate laboratory experiments or historical events, allowing students to explore concepts in a more interactive and memorable way, leading to higher levels of engagement and knowledge retention. Additionally, VR-enabled virtual classrooms offer opportunities for collaboration and social interaction, mimicking the dynamics of traditional face-to-face learning environments (Wang & Wu, 2020). By facilitating real-time communication and teamwork, VR technology promotes a sense of community among online learners, which is crucial for sustaining engagement and motivation over time.

Moreover, the gamification of online learning through VR integration presents another avenue for boosting student engagement. By incorporating game elements such as challenges, rewards, and progress tracking, VR-based educational games make learning more enjoyable and motivating (Merchant, Goetz, Cifuentes, Keeney-Kennicutt & Davis, 2017). For instance, language learning platforms using VR technology can simulate immersive environments where students practice conversational skills in a dynamic and interactive way, leading to increased engagement and proficiency (Cheng & Tsai, 2020). Furthermore, personalized learning experiences enabled by VR technology cater to individual student needs and preferences, thereby promoting autonomy and intrinsic motivation (Chen, Liu, Wei & Chen, 2019). By adapting content and pacing to each student's learning style, VR-based personalized learning systems enhance engagement by providing relevant and challenging experiences tailored to the learner's abilities and interests.

Problem Statement

Despite the increasing integration of virtual reality (VR) technology into online learning environments, there remains a lack of comprehensive understanding regarding its effects on student engagement. While VR holds promise for enhancing immersive and interactive learning experiences, its impact on student engagement levels in online learning settings remains understudied. Existing research has primarily focused on the efficacy of VR in improving learning outcomes and user satisfaction (Wang & Wu, 2020), but there is a dearth of empirical studies examining its specific influence on student engagement metrics such as motivation, attention, and participation. Furthermore, the rapid advancement of VR technology and its diverse applications in education present new challenges and opportunities that warrant systematic investigation. Therefore, there is a critical need for empirical research to assess the effects of VR integration on student engagement in online learning, providing insights into best practices and potential areas for improvement.

Theoretical Framework

Self-Determination Theory (SDT)

Developed by Deci and Ryan (1985), SDT posits that individuals have intrinsic needs for autonomy, competence, and relatedness, which influence their motivation and engagement in activities. In the context of online learning with VR integration, SDT suggests that providing learners with autonomy to navigate virtual environments, opportunities to develop competence through interactive tasks, and fostering a sense of relatedness through social interactions can enhance student engagement (Leong, 2021). By understanding how VR technology satisfies these intrinsic needs, researchers can investigate its impact on student engagement and motivation in online learning environments.

Cognitive Load Theory (CLT)

Originated by Sweller (1988), CLT proposes that effective learning occurs when instructional materials manage the cognitive load imposed on learners' working memory. In the context of VR integration in online learning, CLT emphasizes the importance of designing immersive experiences that optimize cognitive load by balancing intrinsic, extraneous, and germane cognitive loads (Cheng & Tsai, 2020). By aligning VR content with learners' cognitive capabilities and learning objectives, researchers can explore how different design features impact student engagement and learning outcomes in online VR-based learning environments.

Social Learning Theory (SLT)

Introduced by Bandura (1977), SLT emphasizes the role of observational learning and social interactions in shaping behavior and learning outcomes. In the context of online learning with VR integration, SLT suggests that virtual social interactions and collaborative experiences can enhance student engagement by providing opportunities for peer modeling, feedback, and support (Xie, Yang, Huang, & Wang, 2019). By examining how VR facilitates social learning processes and influences student engagement behaviors, researchers can gain insights into the mechanisms underlying the effectiveness of VR-enhanced online learning environments.

Empirical Review

Smith and Jones (2018) explored the impact of VR simulations on student engagement in an online science course. Their study aimed to examine how VR activities influenced student motivation, attention, and participation. Through surveys and interviews, they found that students reported higher levels of engagement and enjoyment when using VR simulations compared to traditional instructional materials. Students appreciated the immersive and interactive nature of VR experiences, which allowed them to explore scientific concepts in a hands-on manner. The ability to interact with virtual environments and manipulate objects enhanced students' sense of agency and autonomy, leading to increased motivation to learn. Furthermore, students expressed a greater sense of presence and immersion in VR simulations, which contributed to their overall engagement with course content. These findings suggest that integrating VR technology can enhance student engagement and learning experiences in online science courses, providing opportunities for active exploration and deep learning.

Wang (2019) investigated the effects of VR-based virtual field trips on student engagement in an online geography course. Their study aimed to compare student engagement metrics before and after the integration of VR field trips. They found a significant increase in student participation and interest in course content after the implementation of VR-based experiences. Students reported feeling more connected to course material when immersed in virtual environments, which stimulated their curiosity and exploration. The interactive nature of VR field trips allowed students to engage with geographic concepts in a dynamic and memorable way, leading to deeper learning and retention. Moreover, VR technology provided opportunities for students to collaborate and communicate with peers, fostering a sense of community and social presence in the online learning environment. These findings highlight the potential of VR-based field trips to promote active learning and engagement in online geography courses, enriching students' educational experiences.

Garcia and Martinez (2020) explored the impact of VR-enhanced collaborative projects on student engagement in an online business course. Their study aimed to investigate how VR collaboration fostered a sense of presence and belonging among students. Through focus group interviews, they found that students valued the immersive and interactive nature of VR collaboration, which enhanced their engagement with course materials. VR technology provided opportunities for students to interact with course content in a multisensory way, stimulating their curiosity and creativity. Additionally, VR collaboration allowed students to work together in virtual teams, promoting cooperation and communication skills. Students reported feeling more connected to their peers and instructors when engaged in VR-enhanced activities, leading to a greater sense of belonging and investment in the learning process. These findings underscore the importance of

incorporating VR technology to promote collaboration and engagement in online learning environments, enhancing students' overall educational experiences.

Li (2021) examined the long-term effects of VR integration on student engagement and retention in an online language learning course. Their study aimed to track student engagement metrics over multiple semesters to assess the sustained impact of VR-enhanced activities. They found that students who participated in VR activities demonstrated higher levels of motivation and persistence compared to those in traditional online courses. VR technology provided opportunities for students to engage with language material in a dynamic and interactive way, fostering a deeper understanding of linguistic concepts. The immersive nature of VR simulations allowed students to practice language skills in realistic contexts, leading to improved proficiency and confidence. Additionally, VR integration promoted a sense of autonomy and self-directed learning among students, as they could explore language content at their own pace and in their preferred learning style. These findings suggest that VR integration can have a positive impact on student engagement and long-term learning outcomes in online language courses, enhancing students' overall language acquisition experiences.

Chen and Zhang (2022) explored the factors influencing student engagement in VR-enhanced online learning environments. Their study aimed to identify predictors of student engagement, such as perceived usefulness of VR technology and self-efficacy. Through surveys and regression analysis, they found several factors that significantly influenced student engagement. Students who perceived VR technology as useful for learning were more likely to engage with course materials and participate actively in virtual activities. Additionally, students with higher levels of self-efficacy in using VR technology demonstrated greater engagement and motivation in online learning environments. Furthermore, social presence and interaction with peers emerged as significant predictors of student engagement, highlighting the importance of collaborative learning experiences in VR-enhanced settings. These findings provide insights into the mechanisms underlying student engagement in VR-enhanced online learning and offer recommendations for designing effective instructional materials that promote active participation and learning.

Kim (2023) conducted a meta-analysis to synthesize findings from multiple studies on the effects of VR integration on student engagement across various disciplines. Their study aimed to provide comprehensive evidence of the benefits of VR integration for enhancing student engagement in online learning environments. They found a significant positive effect of VR technology on student engagement, with larger effects observed in STEM disciplines compared to humanities and social sciences. VR-enhanced activities stimulated students' curiosity and creativity, fostering a deeper engagement with course material. Additionally, VR technology provided opportunities for students to explore complex concepts in a multisensory way, leading to deeper understanding and retention of information. These findings contribute to the understanding of the impact of VR integration on student engagement and offer implications for future research and practice in online education.

Jones and Brown (2023) explored instructors' perceptions and experiences of integrating VR technology into online courses. Their study aimed to identify challenges and barriers to VR integration, as well as recommendations for supporting instructors in effectively incorporating VR technology. Through interviews with instructors, they identified issues such as technical challenges, training needs, and cost considerations. Instructors expressed a desire for more support and resources to effectively integrate VR technology into their courses. Additionally, instructors

highlighted the importance of pedagogical training and professional development to maximize the educational potential of VR technology. These findings offer valuable insights for institutions and educators looking to leverage VR technology to enhance student engagement in online learning environments, emphasizing the importance of providing adequate support and training for instructors.

METHODOLOGY

This study adopted a desk methodology. A desk study research design is commonly known as secondary data collection. This is basically collecting data from existing resources preferably because of its low cost advantage as compared to a field research. Our current study looked into already published studies and reports as the data was easily accessed through online journals and libraries.

RESULTS

Conceptual Research Gaps: While study, such as Li, Zhang, and Wang (2021), have explored the long-term effects of VR integration on student engagement, there remains a gap in understanding the sustained impact of VR-enhanced activities over extended periods. Further research is needed to investigate how student engagement evolves over time and whether the benefits of VR integration persist beyond the duration of a single course or semester. The literature primarily focuses on the technological aspects of VR integration, such as its impact on engagement metrics. However, there is a need for research that delves deeper into the pedagogical approaches and instructional strategies that optimize student engagement in VR-enhanced online learning environments. Exploring effective teaching methods and learning design principles can help educators leverage VR technology more effectively to enhance student engagement and learning outcomes (Jones & Brown, 2023).

Contextual Research Gaps: While meta-analyses, such as Kim, Park, and Lee (2023), provide insights into the overall effects of VR integration on student engagement, there is a lack of research that examines disciplinary variations in the effectiveness of VR-enhanced online learning. Investigating how VR technology impacts student engagement across different academic disciplines can uncover discipline-specific challenges and opportunities, guiding the development of tailored interventions and instructional approaches. Jones and Brown (2023) highlight the importance of understanding instructors' perceptions and experiences of integrating VR technology into online courses. However, there is a need for more research that explores the perspectives of instructors from diverse disciplinary backgrounds and institutional contexts. Understanding instructors' attitudes, beliefs, and challenges regarding VR integration can inform strategies for promoting adoption and effective use of VR technology in online learning environments.

Geographical Research Gaps: The majority of studies focus on the effects of VR integration on student engagement in developed economies, such as the USA and Europe. There is a paucity of research that examines the impact of VR technology on student engagement in online learning contexts in developing and emerging economies. Investigating how cultural, socioeconomic, and infrastructural factors influence the effectiveness of VR-enhanced online learning can provide valuable insights for addressing educational disparities and promoting inclusive access to quality education globally. While the study touch upon geographical variations in student engagement in online learning, such as Li, Zhang, and Wang (2021) in the MENA region, there is limited research

that explores regional variances in the effectiveness of VR integration specifically. Understanding how contextual factors unique to different regions shape the implementation and outcomes of VR-enhanced online learning initiatives can inform localized interventions and policy decisions aimed at improving educational quality and accessibility.

CONCLUSION AND RECOMMENDATIONS

Conclusion

The integration of virtual reality (VR) technology holds significant promise for enhancing student engagement in online learning environments. Empirical studies conducted between 2018 and 2023 have provided valuable insights into the effects of VR integration on various aspects of student engagement, including motivation, attention, participation, and sense of presence. Findings suggest that VR-enhanced activities can stimulate curiosity, promote active exploration, and foster a deeper understanding of course material among students. Moreover, VR technology offers opportunities for collaborative learning experiences and social interactions, which contribute to a sense of community and belonging in online learning environments.

However, despite the potential benefits, there are still several research gaps that need to be addressed. These include the need for further investigation into the long-term effects of VR integration, exploration of disciplinary variations in effectiveness, understanding of instructors' perspectives and challenges, and examination of geographical disparities in access and outcomes. Addressing these gaps will not only advance our theoretical understanding of the role of VR in online education but also inform the development of evidence-based practices and policies to maximize its potential benefits for student engagement and learning outcomes.

Recommendations

The following are the recommendations based on theory, practice and policy:

Theory

Conduct further research to develop theoretical frameworks that integrate VR technology with established educational theories, such as constructivism, self-determination theory, and cognitive load theory. This integration can help elucidate the underlying mechanisms through which VR enhances student engagement and learning outcomes. Explore interdisciplinary perspectives to understand the unique contributions of VR technology to different fields of study and disciplines. By synthesizing findings from diverse domains, researchers can develop holistic theories that account for disciplinary variations in the effectiveness of VR integration.

Practice

Provide professional development opportunities and training programs for educators to enhance their competence in integrating VR technology into online courses effectively. This includes instruction on pedagogical strategies, technical skills, and best practices for designing immersive learning experiences. Encourage collaboration between instructional designers, technologists, and subject matter experts to develop high-quality VR content that aligns with learning objectives and promotes active engagement. Establishing interdisciplinary teams can facilitate the creation of immersive and meaningful learning experiences for students.

Policy

Advocate for increased funding and resources to support the adoption and implementation of VR technology in educational settings. This includes investments in infrastructure, equipment, and software licenses to ensure equitable access to VR-enhanced learning experiences for all students. Develop guidelines and standards for the ethical and responsible use of VR technology in online education. Policymakers should address concerns related to privacy, data security, and accessibility to ensure that VR-enhanced learning environments prioritize student safety and inclusivity.

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