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TEACHERS' ICT COMPETENCY AND THEIR ATTITUDE TOWARDS INTEGRATING VIRTUAL REALITY (VR) AND AUGMENTED REALITY (AR) IN THE CLASSROOM IN IJEBU-ODE LOCAL GOVERNMENT AREA OF OGUN STATE.

[1]Adefuye, Adetayo Linus, [1]Ishola Adebayo Monsuir, [1]Fasina Joke Elizabeth, [2]Adefuye Adesayo Justina

[1]Department of Educational Technology, College of specialized and Professional Education (COSPED) Tai Solarin university of Education, Ijebu Ode

[2]Department of Public and Ineternational Affairs, Faculty of Social Sciences, university of Lagos, Akoka, Lagos State.

Email: linusadefuye@tasud.edu.ng Phone Number: +2348067730313

Abstract

This study investigated teachers' ICT competency and their attitudes toward integrating Virtual Reality (VR) and Augmented Reality (AR) technologies in secondary school classrooms in Ijebu-Ode Local Government, Ogun State. With the increasing role of ICT in education, particularly in the adoption of immersive technologies like VR and AR, this research aims to assess how well teachers are equipped to utilize these technologies and their openness to incorporating them into their teaching practices. Using a descriptive survey design, the study involved 120 teachers selected through a stratified random sampling technique. Data were collected using a validated, self-designed questionnaire, and analyzed using descriptive statistics. The results reveal that teachers generally hold a positive attitude towards integrating VR and AR ($\bar{x}$=2.89). In terms of ICT competency, teachers demonstrate a high level of proficiency ($\bar{x}$=3.07). Teachers are not only proficient in integrating AR and VR but also recognize the value these tools bring to learning environments ($\bar{x}$=3.12). The study concluded that while teachers are confident in their ICT skills, institutional support and continuous professional development are critical to further enhancing their ability to effectively integrate immersive technologies in the classroom. These findings provide insights into the factors influencing the adoption of VR and AR in secondary education and highlight areas for targeted interventions to support teachers in this transition.

Keywords: Teachers' ICT competency, Attitudes, VR and AR

1.0 Introduction

Information and Communication Technology (ICT) has significantly transformed modern education, offering innovative ways to enhance teaching and learning. ICT encompasses various digital tools, including computers, software applications, and internet-based platforms, which facilitate communication, knowledge sharing, and instructional delivery (Ludvik*et al.*, 2018). The adoption of ICT in education has been linked to improved student engagement, enhanced learning experiences, and increased accessibility to educational resources (Kiss, 2017). In many regions, particularly in Africa and developing nations, governments and educational institutions are investing in ICT infrastructure to bridge the digital divide and improve learning outcomes (Flogie *et al.*, 2018). The role of technology in education has evolved from basic computer-assisted learning to more advanced applications, including artificial intelligence, gamification, and immersive technologies like VR and AR. These emerging technologies offer immersive and interactive learning environments that facilitate deeper understanding of complex concepts (Perifanou *et al.*, 2022). VR provides a simulated, computer-generated experience, often through head-mounted displays, allowing students to interact with virtual objects in a controlled setting (Afiya, 2024). Conversely, AR overlays digital content onto real-world environments, enhancing the learning experience by blending digital and physical realities (Tuli & Mantri, 2021). The use of VR and AR in education is gaining traction globally, yet its adoption is still met with challenges, particularly regarding teachers' ICT competency and their attitudes toward these technologies (Matzke *et al.*, 2017).

Teachers' ICT competency refers to their ability to effectively use digital tools for instructional purposes, administrative tasks, and professional development (Garcia-Bonete *et al.*, 2019). This competency is crucial in the 21stcentury learning environment, where students increasingly rely on digital platforms for education. According to Rauschnabel *et al.* (2018), ICT competency encompasses technical skills, digital literacy, and the ability to integrate technology into pedagogy effectively. Teachers proficient in ICT can leverage digital resources to create engaging and interactive lessons, ultimately enhancing students' academic performance (Harborth & Pape, 2021). Developing ICT competency among teachers requires continuous training and professional development. Many educational institutions and governments offer training programs aimed at improving teachers' digital literacy and equipping them with the skills to use advanced educational technologies (Slater *et al.*, 2020). The importance of ICT skills for teachers extends beyond basic digital literacy. Effective use of ICT enables teachers to employ innovative teaching strategies such as blended learning, flipped classrooms, and gamification to enhance student engagement (Yoon *et al.*, 2017). Moreover, ICT competency is essential for leveraging VR and AR technologies, as these tools require a higher level of technical proficiency and pedagogical adaptation (Hwang & Chen,

2017). As VR and AR continue to gain prominence in education, ensuring that teachers are equipped with the necessary skills to integrate these technologies effectively is imperative. Teachers' attitudes toward VR and AR integration play a crucial role in determining the success of these technologies in classrooms. While some educators embrace these tools as transformative learning aids, others remain hesitant due to concerns about accessibility, cost, and technical challenges (Perifanou *et al.*, 2022).

In order to encourage positive attitudes toward VR and AR integration, professional development programs must focus on hands-on training and real-world applications (Perifanou *et al.*, 2022). Teachers need practical experience in using VR and AR tools to develop confidence in their ability to integrate these technologies effectively. Additionally, creating a supportive community of educators who share best practices and success stories can help build enthusiasm for VR and AR adoption (Nikou *et al.*, 2024). Policymakers should also consider providing incentives, such as grants and funding opportunities, to schools that implement VR and AR in their curricula (da Silva *et al.*, 2019). Hence, it is therefore imperative to investigate teachers' ICT competency and their attitudes towards integrating VR and AR in the classroom. Specifically, the objectives of the study are:
To examine teachers' attitudes towards integrating VR and AR in the classroom;

To determine the level of teachers' ICT competence towards the use of VR and AR;

To investigate the integration of AR and VR into classroom instruction.

1.1 Teachers' Attitudes Towards Integrating VR and AR in the Classroom

The integration of Virtual Reality (VR) and Augmented Reality (AR) in educational settings has gained significant attention due to its potential to enhance learning experiences. Teachers' willingness to adopt these technologies is influenced by multiple factors, including digital competence, perceived usefulness, and institutional support. Belda-Medina and Calvo-Ferrer (2022) highlight that teachers with higher digital literacy and ICT competence are more inclined to integrate AR in their teaching practices. The TPACK framework, which assesses technological pedagogical content knowledge, suggests that teachers who understand how to align VR and AR with curricular objectives tend to exhibit a more positive disposition towards their adoption (Buchner & Zumbach, 2020). Another factor affecting teachers' willingness to embrace VR and AR is their personal attitude towards technology. Arici *et al.* (2021) emphasize that educators who view technology as an enabler of innovative pedagogy are more receptive to its use in classrooms. Moreover, the level of perceived ease of use and accessibility also determines the adoption rate. Teachers who find AR applications user-friendly are more likely to implement them in their instructional strategies (Garzón *et al.*, 2019).
Institutional factors, including administrative support, access to digital infrastructure, and availability of technical assistance, play a crucial role in determining teachers' adoption of VR and AR. A study by Barroso Osuna *et*

al. (2019) identified that teachers in institutions with a strong emphasis on digital transformation were more enthusiastic about using AR and VR. In contrast, those working in environments with minimal technological investment showed reluctance in adopting these tools. Similarly, Mwesigye *et al.* (2022) stress the importance of parental and administrative support in facilitating the integration of technology in primary and secondary education. Cultural factors also influence the adoption of VR and AR. Ugwu *et al.* (2023) argue that in African educational settings, where traditional teaching methods are still predominant, teachers often struggle with transitioning to technology-enhanced learning. However, when properly introduced to the benefits of VR and AR, such as interactive simulations and immersive learning experiences, they become more receptive to integrating these technologies. Despite the benefits associated with VR and AR, teachers face several barriers that hinder their successful integration. One of the primary concerns is the high cost of VR and AR equipment. Cheng (2018) points out that many educational institutions, particularly in developing countries, lack the financial resources to procure and maintain these technologies. Consequently, teachers in underfunded schools struggle to implement VR and AR in their classrooms.

1.2 Teachers' ICT Competence

In the 21st century, technology plays a pivotal role in shaping education. Teachers' competencies in Information and Communication Technology (ICT) are crucial for preparing students for a technology-driven world. The integration of ICT into teaching enhances learning outcomes by promoting active participation, critical thinking, and collaboration. Consequently, teachers' ICT competence has become a fundamental aspect of modern education. With the increasing demand for digital literacy, educators must possess a wide range of ICT skills to effectively integrate digital tools like VR and AR in their classrooms (Tukundane *et al.*, 2020). In an era where technology influences almost every aspect of life, equipping teachers with ICT skills is vital for fostering effective learning environments. As digital tools become increasingly integral to the educational process, teachers must be adept at using these tools to engage students, enhance creativity, and streamline instructional practices (Bwambale *et al.*, 2024). ICT integration has been found to improve students' problem-solving abilities, creativity, and overall academic performance by offering interactive and immersive learning experiences (Bae & Lai, 2020).

1.3 Existing Frameworks for Assessing Teachers' ICT Competency

Several frameworks have been developed to assess teachers' ICT competencies. One notable framework is the European Union's "ICT Competence Framework for Teachers," which outlines a set of competencies necessary for integrating ICT into teaching and learning processes (Bae & Lai, 2020).

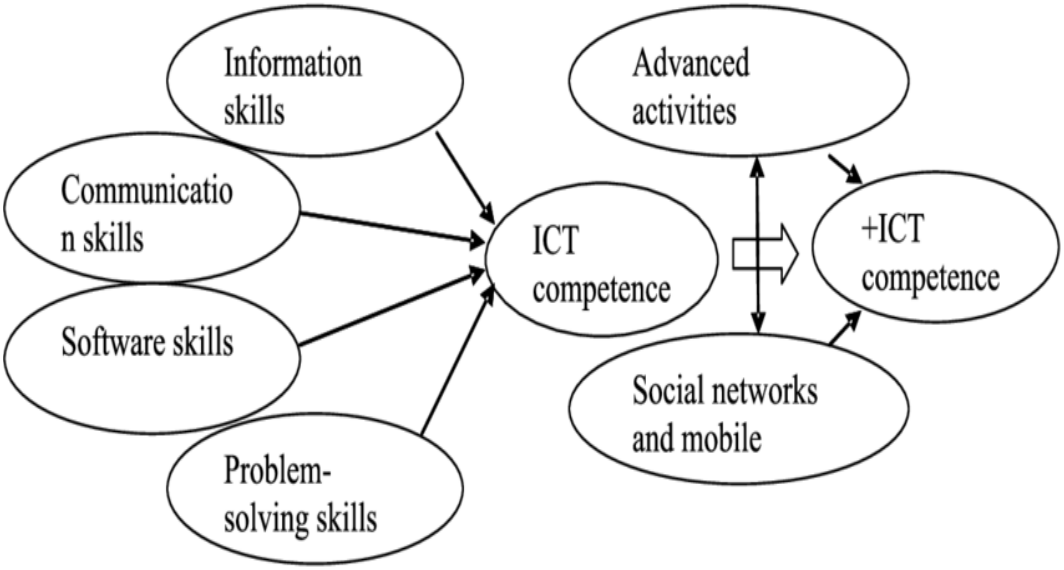
1.4 ICT Competence: Advanced Activities, Social Networks, and Mobile Learning

Teachers' ICT competence is not limited to basic computer skills. As digital technologies

evolve, educators are required to master advanced activities such as the use of social networks and mobile learning tools. Social networks provide teachers with platforms to share resources, engage in professional discussions, and collaborate with peers across the globe (Omweri *et al.*, 2023). Mobile learning, which involves using smartphones and tablets for educational purposes, is also becoming increasingly important in the modern classroom. It offers teachers and students flexibility in terms of time and location. Teachers with high levels of mobile ICT competence can design learning experiences that are both engaging and accessible to students, regardless of their geographical location (Abura *et al.*, 2022).

1.5 ICT Competence: Information Skills, Communication Skills, Software Skills, and Problem-Solving Skills

To effectively integrate ICT into teaching, teachers must possess a comprehensive set of skills. Information skills, which include the ability to search for, evaluate, and manage digital information, are essential for teachers in today's information-rich environment. These skills enable teachers to find credible sources of information, which they can use to create relevant and accurate content for their students (Siambe *et al.*, 2023). Communication skills are equally important. Teachers must be proficient in using digital communication tools such as email, instant messaging, and video conferencing platforms to interact with students, parents, and colleagues (Bwambale *et al.*, 2024). Software skills are also fundamental to teachers' ICT competency. Teachers must be able to use a wide range of educational software, including learning management systems, presentation tools, and assessment platforms, to support their teaching practices (Pirir *et al.*, 2022). Being proficient in these software applications enables teachers to deliver lessons effectively, track student progress, and provide timely feedback. Finally, problem-solving skills are crucial in navigating the challenges that arise from integrating technology into teaching. Teachers with strong problem-solving abilities can troubleshoot technical issues, adapt to new technologies, and modify their teaching approaches to meet the diverse needs of their students. Problem-solving skills also enable teachers to design innovative learning experiences that make full use of available ICT tools (Samanya & Kusemererwa, 2023)



Source: Ludvik, Milan, Lukasz, Maria and Gabriela (2018)

1.6 Integrating AR and VR into Classroom Instruction

The integration of Augmented Reality (AR) and Virtual Reality (VR) into classroom instruction represents a significant transformation in the education sector. These immersive technologies offer diverse possibilities for enhancing engagement, personalized learning, hands-on experiences, collaborative learning, and teacher professional development. However, integrating AR and VR into teaching practices requires teachers to possess specific ICT competencies to effectively utilize these technologies.

1.6.1 Enhancing Engagement and Interaction: One of the most prominent advantages of AR and VR in the classroom is their ability to enhance student engagement and interaction. The immersive nature of these technologies captures students' attention and makes learning more interactive (Tuli & Mantri, 2021).

1.6.2 Personalized Learning Paths: AR and VR offer personalized learning paths tailored to individual students' needs. Unlike traditional teaching methods that often follow a one-size-fits-all approach, these technologies provide opportunities for adaptive learning experiences. For example, VR can immerse students in simulations that adjust based on their responses, allowing them to learn at their own pace (Yoon *et al.*, 2017).

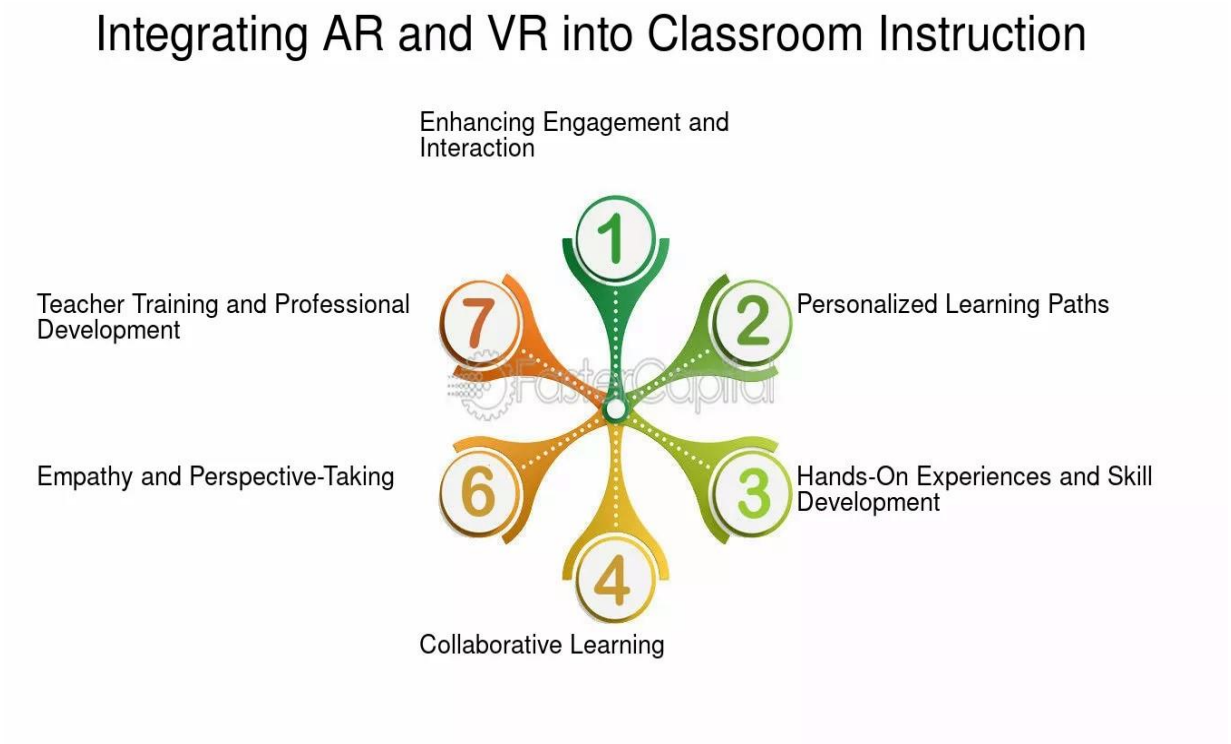
1.6.3 Hands-On Experiences and Skill Development: AR and VR technologies allow students to engage in hands-on learning experiences that would be difficult or impossible in traditional classroom settings. These experiences are particularly beneficial in subjects that require practical application

of concepts, such as science, engineering, and medical education (Arici *et al.*, 2021).

1.6.4 Collaborative Learning: AR and VR also facilitate collaborative learning by enabling students to work together in shared virtual environments. Collaborative tasks in VR settings allow students to interact with one another, solving problems or completing projects in virtual spaces. This fosters teamwork, communication, and problem-solving skills, which are critical for students' academic and professional success (Arici *et al.*, 2021).

1.6.5 Empathy and Perspective-Taking: AR and VR have a unique ability to promote empathy and perspective-taking among students by immersing them in scenarios that they would not typically experience. For instance, VR can simulate the experiences of marginalized groups, allowing students to understand different perspectives and foster social awareness (Arici *et al.*, 2021).

1.6.6 Teacher Training and Professional Development: The successful integration of AR and VR into classroom instruction requires teachers to be adequately trained in these technologies. Teacher competence in using AR and VR tools is crucial for maximizing the benefits of these technologies in education (Arici *et al.*, 2021).



Source: Garcia-Bonete *et al.* (2019)

2.0 RESEARCH METHOD

2.1 Research Design

This study adopted a descriptive survey research design, which was deemed appropriate due to its ability to facilitate the collection of data from a large sample in a relatively short period.

2.2 Population of the Study

The target population for this study comprised secondary school teachers from five (5) selected schools within Ijebu-Ode Local Government, Ogun State. The population of the study was 238 teachers.

2.3 Sampling Technique and Sample

A stratified random sampling technique was employed to select 120 respondents, which represented approximately 50% of the population. This sampling technique ensured that teachers from each school were adequately represented in the study, reflecting the diversity of the schools' characteristics. The breakdown of the sample is as follows:

Table 1: Population of the study

S/N	Secondary School	Year of Establishment	Population	Sample (0.5%)
1	Adeola Odutola College	1964	57	29
2	Moslem Comprehensive High School	1972	36	18
3	Ijebu-Ode Grammar School	1913	54	27
4	Ijebu Muslim College	1950	52	26
5	Our Lady of Apostle Secondary School	1954	39	20
	Total		**238**	**120**

2.4 Research Instrument

Data for this study were collected using a validated, self-designed, close-ended questionnaire.

2.5 Procedure for Data Collection

Data was collected through the administration of the questionnaire. The researcher personally distributed and collected the completed questionnaires from the selected teachers. This method ensured that the process was closely monitored, and the data collected was solely used for the purpose of this study.

2.6 Procedure for Data Analysis

The collected data were analyzed using descriptive statistics, including frequency counts, percentages, mean and standard deviation.

3.0 RESULTS AND DISCUSSION

3.1 Results

RQ 1: What are teachers' attitudes towards integrating VR and AR in the classroom?

Table 2: Descriptive Analysis of Research Question One: Teachers' Attitudes Towards Integrating VR and AR

S/N	Items	SA (Freq. %)	A (Freq. %)	D (Freq. %)	SD (Freq. %)	Mean	Std. Dev.
1	I believe that integrating VR and AR in the classroom enhances learning.	85 (35.7%)	100 (41.7%)	40 (16.7%)	13 (5.4%)	3.08	0.90
2	I feel confident in using VR and AR for teaching various subjects.	78 (32.5%)	98 (40.8%)	36 (15.0%)	18 (7.5%)	2.98	1.01
3	I am enthusiastic about the potential of VR and AR for classroom instruction.	92 (38.3%)	85 (35.4%)	40 (16.7%)	13 (5.4%)	3.11	0.91
4	I believe VR and AR are too complex to integrate into regular teaching.	26 (10.8%)	58 (24.2%)	99 (41.3%)	55 (22.9%)	2.20	1.06
5	I think that using VR and AR will make teaching more engaging for students.	87 (36.3%)	92 (38.3%)	45 (18.8%)	14 (5.8%)	3.06	0.94
	Average Mean					**2.89**	

Decision Rule: A criterion mean score of 2.50 and above is considered significant.

Table 2 presents the analysis of teachers' attitudes towards integrating VR and AR in the classroom. The results indicate a generally positive attitude towards the integration of these technologies. Teachers strongly agreed that VR and AR enhance learning ($\bar{x}$ = 3.08) and make teaching more engaging for students ($\bar{x}$ = 3.06). They also expressed enthusiasm about the potential of VR and AR in classroom instruction ($\bar{x}$ = 3.11). However, the item indicating that VR and AR are too complex to integrate into regular teaching received a lower mean score ($\bar{x}$ = 2.20).

With an average mean score of 2.89, the findings indicate an overall positive attitude

towards integrating VR and AR, suggesting that most teachers recognize the value of these technologies in improving educational experiences.

RQ 2: What is the level of teachers' ICT competence towards the use of VR and AR?

Table 3: Descriptive Statistical Analysis of Teachers' ICT Competence Towards the Use of VR and AR

S/N	Items	Mean	Std. Dev.
1	I am proficient in using advanced ICT tools for educational purposes.	3.12	0.82
2	I can use social networks effectively for educational communication and collaboration.	2.98	0.76
3	I regularly use mobile learning applications to support my teaching.	3.05	0.79
4	I possess strong information skills, such as searching, organizing, and analyzing digital content.	3.22	0.74
5	I can effectively communicate with students through various ICT tools (e.g., email, messaging).	3.10	0.81
6	I am confident in using software programs necessary for integrating VR and AR into lessons.	3.14	0.78
7	I can solve basic technical problems that arise while using ICT tools in the classroom.	3.00	0.83
8	I am capable of troubleshooting and resolving issues related to mobile learning platforms.	2.92	0.85
9	I am skilled in using social media platforms to enhance students' learning experiences.	2.95	0.80
10	I feel confident using ICT tools to create immersive learning experiences with VR and AR.	3.18	0.75
	Average Mean	**3.07**	

Decision Rule: A criterion mean score of 3.00 and above is considered proficient.

Table 3 shows the descriptive statistics for teachers' ICT competence towards the use of VR and AR in the classroom. The mean scores range from 2.92 to 3.22, indicating

that teachers are generally proficient in their ICT competence across the different competencies outlined in the study's framework. Teachers reported strong proficiency in information skills ($\bar{x}$ = 3.22), software skills ($\bar{x}$ = 3.14), and advanced ICT tools for educational purposes ($\bar{x}$ = 3.12).They also expressed confidence in using mobile learning applications ($\bar{x}$ = 3.05) and integrating social networks for educational purposes ($\bar{x}$ = 2.98).Teachers showed a good level of competence in communication skills ($\bar{x}$ = 3.10) and problem-solving skills ($\bar{x}$ = 3.00), particularly when using ICT tools and addressing technical issues in the classroom.

With an average mean score of 3.07, falling above the threshold of 3.00, indicates that the teachers involved in the study possess a high level of competence in ICT, which is essential for effectively integrating VR and AR technologies into the classroom. This implies that teachers are well-prepared for using these advanced technologies, although further training may still be beneficial to enhance their problem-solving and mobile learning integration skills.

RQ 3: What are the effects of integrating AR and VR into classroom instruction?

Table 4: Descriptive Statistical Analysis of the Integration of AR and VR into Classroom Instruction

S/N	Items	Mean	Std. Dev.
1	I actively use AR and VR technologies to enhance student engagement in my classroom.	3.14	0.77
2	I tailor my lessons to include personalized learning paths through AR and VR technologies.	3.10	0.79
3	I encourage students to explore hands-on experiences and skill development through AR and VR.	3.12	0.80
4	I integrate collaborative learning activities using AR and VR tools in my classroom.	3.08	0.75
5	AR and VR technologies help me to foster empathy and perspective-taking among students.	3.05	0.82
6	I regularly participate in professional development programs to enhance my AR and VR integration.	3.20	0.73
7	I provide students with opportunities to interact and collaborate using AR and VR.	3.17	0.78

8	I find AR and VR technologies to be effective tools in improving student learning outcomes.	3.13	0.76
9	I feel confident in adapting my teaching methods to effectively integrate AR and VR.	3.18	0.71
10	I have access to the necessary resources to effectively integrate AR and VR into my lessons.	3.11	0.80
	Average Mean	**3.12**	

Decision Rule: A criterion mean score of 3.00 and above is considered proficient.

Table 4 presents the descriptive statistics for the integration of AR and VR into classroom instruction. The mean scores for the items range from 3.05 to 3.20, reflecting that teachers are actively and proficiently integrating AR and VR technologies into their instructional practices. Teachers reported strong integration of AR and VR in enhancing student engagement ($\overline{x}$ = 3.14), hands-on experiences and skill development ($\overline{x}$ = 3.12), and collaborative learning ($\overline{x}$ = 3.08).Teachers also emphasized the role of AR and VR in fostering empathy and perspective-taking among students ($\overline{x}$ = 3.05).On the professional development front, teachers felt confident in their ability to integrate these technologies, with a high score in their confidence to adapt teaching methods ($\overline{x}$ = 3.18) and participation in training programs ($\overline{x}$ = 3.20).

Hence, the findings showed that teachers are not only proficient in integrating AR and VR but also recognize the value these tools bring to learning environments. This level of proficiency highlights the teachers' readiness to implement immersive, interactive, and personalized learning experiences, though continued professional development could further enhance their expertise and resource access.

3.2 Discussion of Results

The study showed that teachers possess positive attitude towards integrating VR and AR, which also implies that most teachers recognize the value of these technologies in improving educational experiences. This finding aligns with the study of Arici *et al.* (2021), who assert that educators who view technology as an enabler of innovative pedagogy are more receptive to its use in classrooms. According to Belda-Medina and Calvo-Ferrer (2022), teachers with higher digital literacy and ICT competence are more likely to adopt AR in their teaching practices. This positive attitude towards technology adoption is further supported by the TPACK framework, as noted by Buchner &Zumbach (2020), which highlights that teachers who align VR and AR with curricular objectives are more inclined to integrate these tools into their teaching methods.

The study showed that teachers possess a high level of competence in ICT, which is essential for effectively integrating VR and AR technologies into the classroom, which

also implies that teachers are well-prepared for using these advanced technologies. This finding aligns with Tukundane *et al.* (2020), who emphasize the importance of ICT competency in equipping teachers to use advanced tools like VR and AR. Bwambale *et al.* (2024) further affirm that a high level of ICT competence enhances teachers' ability to engage students through immersive and interactive learning experiences. Moreover, Samanya & Kusemererwa (2023) highlight that teachers proficient in ICT are more capable of utilizing various educational technologies, such as VR and AR, to improve teaching practices.

The study showed that teachers are not only proficient in integrating AR and VR but also recognize the value these tools bring to learning environments, which also implies that this level of proficiency highlights the teachers' readiness to implement immersive, interactive, and personalized learning experiences, though continued professional development could further enhance their expertise and resource access. This finding aligns with the study of Afiya (2024), who noted that teachers who are proficient in AR and VR recognize the value these tools bring to learning environments, particularly in enhancing student engagement and providing personalized learning experiences. Mystakidis *et al.* (2022) also emphasize that teachers who are proficient in immersive technologies can implement more effective and interactive learning methods, which cater to diverse student needs. However, despite their proficiency, the study highlights the importance of ongoing professional development.

4.0 Conclusion

In conclusion, there is a generally positive outlook among teachers towards these advanced technologies, with a clear recognition of their potential in improving educational experiences. Teachers' attitudes were significantly influenced by personal beliefs, digital literacy, and institutional support, suggesting that even when teachers are inclined to use VR and AR, the level of institutional investment in technology plays a critical role in their adoption. Teachers demonstrated a high level of ICT competency, which was essential for the successful integration of VR and AR. This proficiency is crucial, as these technologies demand not only technical skills but also pedagogical expertise to be effectively implemented in the classroom. While teachers were proficient in using these tools and recognized their value in providing immersive and interactive learning environments, ongoing professional development was necessary to further enhance their expertise and ensure they remain effective in using emerging technologies. Teachers are ready to embrace VR and AR but would benefit from continuous support and professional development to maximize the potential of these tools. This readiness is essential for providing personalized learning experiences and improving student engagement, which are key objectives of modern education.

Recommendations

In view of the findings, the following recommendations were suggested:

- Universities should invest in technological infrastructure to support the integration of VR and AR in classrooms, ensuring that teachers have access to the necessary resources.
- Teacher training programs should incorporate specialized modules on the integration of VR and AR, emphasizing both technical and pedagogical skills for effective use in teaching.
- Educational policymakers should prioritize the development and implementation of continuous professional development opportunities for teachers to stay updated on emerging technologies.
- School administrators should encourage collaborative efforts among teachers, fostering a community of practice where knowledge on VR and AR integration can be shared and enhanced.
- Government agencies should allocate funding to support the procurement of VR and AR tools and resources, particularly in underserved schools, to ensure equal access to advanced learning technologies.

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