INFLUENCE OF LECTURERS' 4IR-SKILLS ON THEIR USE OF VIRTUAL LEARNING PLATFORMS FOR TEACHING IN UNIVERSITIES IN KWARA STATE

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Abstract

This study examined lecturers' Fourth Industrial Revolution (4IR) skills and their influence on the use of Virtual Learning Platforms (VLPs) for teaching in universities in Kwara State, Nigeria. As higher education continues to embrace technology-driven instruction, lecturers' digital competencies play a pivotal role in determining the effective integration of VLPs such as Moodle, Google Classroom, and Microsoft Teams. Guided by the descriptive survey design, the study targeted university lecturers across federal, state, and private institutions in Kwara State. A sample of 50 lecturers was randomly selected, and data were collected using the Questionnaire on Lecturers' 4IR Skills and Use of Virtual Learning Platforms for Teaching in Universities in Kwara State (QL4SUVLPTUKS). The instrument measured lecturers' technological proficiency, adaptability, and self-efficacy in relation to their use of VLPs. Data were analysed using descriptive and inferential statistics at a 0.05 level of significance (t-test and linear regression). Findings revealed that lecturers in Kwara State possess a high level of 4IR skills, particularly in digital literacy, critical thinking, and ethical information use, utilise virtual learning platforms, predominantly using Google Classroom, Google Meet, Zoom, WhatsApp, Telegram, and Microsoft Teams, while Edmodo, Canvas, and Schoology are underutilised; they possess high levels of 4IR skills with no significant gender differences, and their 4IR skills do not significantly influence VLP usage. The study concludes that lecturers' 4IR competencies are critical enablers of effective virtual instruction and recommends continuous professional development, institutional support, and mentorship programs to strengthen digital teaching capabilities. These efforts will promote sustainable technology adoption and improve pedagogical outcomes in universities.

Keywords: Fourth Industrial Revolution (4IR), Virtual Learning Platforms, Digital Literacy, University Lecturers,

Introduction

Higher education is experiencing a profound transformation as technology integration redefines traditional approaches to teaching and learning. The landscape of technology integration in higher education has evolved significantly over the past decade, with institutions increasingly embracing digital transformation to enhance teaching and learning processes (Akour & Alenezi, 2022) This transformation has been driven by several factors, including the need to prepare students for a digitally-driven workforce, the demand for more flexible and accessible education options, and the potential for improved learning outcomes through technology-enhanced instruction (Grimus, 2020). Akram et al. (2021) indicate that effective technology integration in higher education requires a comprehensive approach that encompasses infrastructure development, professional development for faculty, and institutional support systems. Heilporn et al. (2021), emphasize that universities that successfully implement technology integration strategies experience increased student engagement, improved learning outcomes, and enhanced institutional efficiency.

Digital literacy has emerged as a crucial factor in the successful adoption and utilization of educational technologies. According to Yeşilyurt and Vezne (2023), individuals with higher levels of digital literacy demonstrate greater confidence in implementing technology-based teaching methods and show more positive attitudes toward digital innovation in education. This relationship between digital literacy

and technology adoption is particularly significant in the context of virtual learning platforms, where educators must navigate complex digital tools and systems (Nikou & Aavakare, 2021). To harness the full potential of VLPs, lecturers are required to develop some skills that align with their roles as educators, collaborators, and content creators.

These skills are captured in the concept of 4IR-skills, which are a set of skills that will enable lecturers to thrive in the usage of VLPs. Fourth Industrial Revolution (4IR) skills are a comprehensive set of competencies that extend beyond basic digital literacy, enabling lecturers to integrate advanced technologies into their pedagogical practices (Aboderin & Havenga, 2024). These capabilities include: Technological proficiency to ensure mastery of diverse VLPs such as Moodle, Blackboard, and Microsoft Teams. Data literacy to empower educators to analyse and interpret data for personalized learning experiences. Furthermore, creativity and innovation enable lecturers to develop engaging, interactive content, while digital collaboration skills facilitate effective communication and teamwork in virtual spaces (Aithal & Aithal, 2023). Adaptability and lifelong learning are the key components of 4IR-skills that enable educators to respond effectively to rapid technological advancement and overcome challenges in VLPs integration (Noverça, 2022). These skills significantly influence lecturers' propensity to utilize VLPs by enhancing their confidence and capability to leverage these platforms effectively. This ensures the creation of impactful, student-centred learning experiences.

According to Hassan *et al.* (2022), educators are supposed to create innovative partnerships with e-teachers, which entail critical thinking, collaboration, and creativity in virtual learning environments enriched by immersion and interaction. There are two types of higher education institutions: traditional universities, where teaching and learning occur through face-to-face interactions between lecturers and students, and distance education institutions, where learning happens remotely. VLPs represent a disruptive innovation in conventional face-to-face universities (Gubiani *et al.*, 2020), in the sense that it is a new paradigm of education delivery, transforming the conventional methods of teaching and learning. Traditional learning is education provided at face-to-face universities, typically conducted in a designated setting such as a classroom (Singh *et al.*, 2022).

Moreover, the emergence of VLP is introducing innovative teaching methods that are transforming and challenging traditional approaches. Lecturers and students are the key implementers of e-learning. Lecturers play a crucial role in the successful implementation of an e-learning system, acting similarly to the opinion leaders described by Rogers (2010) cited in Boland, 2020). Therefore, the adoption of VLPs by lecturers tends to have a direct influence on students' adoption of these technologies (Liu, 2021). The lecturer's knowledge, understanding, and adoption of these technologies are essential for the successful implementation of VLPs (Priatna *et al.*, 2020). There is growing interest in enhancing the quality of content delivery and improving pedagogy in higher education institutions. The VLPs have emerged as a successful, viable learning management platform for teaching and learning in the 21st century. Zamora-Antuñano *et al.* (2021) defined VLP as a flexible, effective, and inspiring way to deliver learning content that best suits the needs of students.

During the COVID-19 pandemic, educators across the globe rapidly transitioned from traditional classroom teaching to VLPs within just a few days (Zamora-Antuñano *et al.*, 2021). Still, this global pandemic exposed a significant gap in teacher training in a remote environment. During the crisis, lecturers' experiences with using VLPs highlighted the need to differentiate between demographic factors that significantly influence their satisfaction and those with little or no impact.

Despite the global advancements in technologies, particularly the integration of VLPs, there remains a significant gap in the adoption and lecturers' use of virtual platforms for teaching in the universities, where the influence of 4IR-Skills on lecturers' use of VLPs for teaching remains largely unexplored. While VLPs has the potential to revolutionise education by providing immersive and interactive learning experiences, its impact is contingent upon the awareness of lecturers on their use of such technology. The dearth of studies investigating the lecturers' use of VLPs in Kwara State raises concerns about the region's preparedness to embrace this transformative technology. Therefore, this addresses this gap by exploring the awareness levels, influence, and challenges of lecturers on their use of VLPs in Kwara State, Nigeria.

Statement of the Problem

The increasing reliance on digital technologies in higher education, driven by the Fourth Industrial Revolution (4IR), has made Virtual Learning Platforms (VLPs) an essential component of modern teaching. These platforms, including Moodle, Google Classroom, and Microsoft Teams, offer opportunities for remote instruction, resource sharing, and interactive learning. A crucial factor in technology adoption is possessing 4IR skills, such as digital literacy, proficiency with advanced technology, technical self-efficacy, adaptability, lifelong learning, critical thinking, and technological adaptability. These skills positively influence the use of virtual learning platforms by enabling lecturers to effectively navigate, integrate, and leverage these tools for teaching and learning. They encompass advanced digital, technological, and cognitive abilities, including digital literacy, critical thinking, problem-solving, and the effective use of emerging technologies, that enable educators and learners to interact with, manage, and optimise online teaching and learning tools. These skills are particularly important for educators, as they enhance their ability to engage with digital tools and foster critical thinking in students (Tella et al., 2023). In addition, 4IR-skills such as adaptability and lifelong learning, technical self-efficacy, and proficiency with advanced technology have become increasingly necessary for effective teaching in technology-driven environments (Blignaut & Botha, 2024). Previous research has explored various aspects of digital competencies in education, identifying factors such as attitude, perceived ease of use, institutional support, and self-efficacy as key determinants of lecturers' adoption of technology (Sharma & Saini, 2022).

However, there is still a gap in the literature regarding how 4IR skills impact lecturers' ability to integrate VLPs into their teaching practices. Furthermore, much of the existing research focuses on students' experiences with VLPs, with limited attention given to lecturers' perspectives, especially in regions like Kwara State, where technological infrastructure may pose additional challenges. Given these gaps, this study seeks to examine the extent to which 4IR-skills influence lecturers' use of Virtual Learning Platforms for teaching in Universities in Kwara State**.**

Purpose of the Study

The main purpose of this study is to investigate the lecturers' 4IR-Skills and its influence on the lecturers' use of virtual learning platforms for teaching in universities in Kwara State. Specifically, the study:

1. determine virtual learning platforms university lecturers use for teaching?
2. identify the 4IR-skills universities lecturers possess for teaching in Kwara State;
3. determine the influence of universities lecturers' 4IR skills on their use of VLPs for teaching in Kwara State; and
4. determine the difference in male and female universities lecturers' 4IR-skills for using virtual learning platforms in Kwara State.

Research Questions

The following research questions were formulated to guide the study:

1. What are the virtual learning platforms university lecturers use for teaching?

2. What 4IR-skills universities lecturers possess for teaching in Kwara State?

Research Hypotheses

The research hypotheses will be tested at a 0.05 level of significance:

$H_0$1: There is no significant influence on university lecturers' 4IR-skills on their use of VLPs for teaching in Kwara State.

$H_0$2: There is no significant difference between male and female university lecturers' 4IR-skills in Kwara State.

Literature Review

Technology has become an indivisible part of our lives. It has transformed the way we work, think, and play. According to Wu and Liu (2021), technology is a strong factor in driving social, economic, educational, and political reforms. The seamless integration of technology has transformed the educational landscape, revolutionizing the way students learn and teachers instruct and ultimately enhancing the overall teaching-learning experience (Kokkinos, 2024). Shoraevna et al. (2021) describe the integration of Information and Communication Technology (ICT) in education as the utilization of various digital tools, applications, and resources to enhance teaching, learning, and educational administration. This process incorporates digital technologies into educational practices to improve communication, facilitate information access, promote collaboration, and develop essential skills for the modern digital age. According to Yusuf et al. (2022), information and Communication Technology (ICT) advancement gathers speed for data processing and more efficiency in all aspects of human life. The primary goal is to revolutionize traditional educational approaches by leveraging technology to enhance learning quality, increase engagement, and provide access to diverse educational materials (Veluvali & Surisetti, 2022). Kalyani (2024) emphasises that by incorporating ICT, education becomes more personalized, fostering student-centered learning that encourages critical thinking, problem-solving, digital literacy, and other essential 21st-century skills.

The Fourth Industrial Revolution (4IR) represents a significant shift in our technological landscape, characterized by the fusion of digital, physical, and biological systems (Ibegbulam et al., 2023). Various developments have made the Fourth Industrial Revolution (4IR) uniquely transformative making it comprehensive in terms of its impact on all facets of life (Uwaoma et al., 2023). To fully grasp the Fourth Industrial Revolution (4IR), it's important to look at the previous three industrial revolutions, as each one brought about major advancements that paved the way for the next. The first industrial revolution involved mechanization and the use of steam power, The Second Industrial Revolution was powered by electricity while the Third Industrial Revolution focused on digital technology, including computers and information systems (Groumpos, 2021).

However, 4IR isn't just a combination of past industrial revolutions or specific advancements; it demands a completely new perspective on a connected, complex society with many layers and unforeseen challenges that will reshape the future. As the 4IR brings about transformative changes in industries across the globe, universities are experiencing a significant shift in how they operate. At the rate of these changes are the integration of automation, artificial intelligence (AI), virtual reality, and big data analytics, all of which are reshaping teaching practices and the role of lecturers (George & Wooden, 2023). According to Wafula (2025), Universities were traditionally seen as centres of face-to-face instruction, and are now evolving into dynamic hubs of digital learning and technology-enhanced education. Muzuva (2024), stated that this technological shift requires lecturers to acquire new skills and adapt to a rapidly changing environment, particularly as they navigate the challenges and opportunities presented by the 4IR. One of the most significant challenges lecturers face in the 4IR era is the need to update their skill sets to keep pace with technological advancements.

Rana et al. (2024), emphasize that lecturers are no longer just content deliverers; they are evolving into teach-experience designers, digital facilitators, and mentors in technology-enhanced environments, guiding students through the complexities of new learning technologies and helping them navigate the vast amounts of digital information available. However, as universities adopt more advanced technologies, such as virtual learning environments, AI-driven assessment systems, and learning analytics platforms, lecturers are developing expertise in these areas to ensure they can operate and manage these systems effectively. For example, some universities have implemented advanced virtual laboratories for practical sessions, while others have deployed adaptive learning systems to personalize student learning experiences (Hassan et al., 2022). According to Olaitan et al. (2024), integrating such technologies requires lecturers to acquire specific 4IR skills, including digital pedagogy, learning analytics, and virtual content creation.

However, the transition to technology-enhanced teaching comes with its own set of challenges. The increased digitalization of education may lead to role modifications, especially for those lecturers who are

not equipped with the necessary technological skills. As Krishnannair et al. (2022) highlight, the 4IR is creating a divide between technologically skilled and unskilled educators, and lecturers who fail to keep up with technological advancements may find themselves at a disadvantage. To mitigate this risk, it is crucial for lecturers to continuously update their knowledge and adapt to new tools, ensuring that they remain valuable assets to their institutions. The integration of 4IR skills among university lecturers requires systematic assessment, targeted training, and continuous support. Success in developing these competencies demands careful consideration of institutional context, available resources, and the specific needs of both educators and students. By focusing on continuous professional development, infrastructure enhancement, and the adoption of appropriate educational technologies, universities can support their lecturers in developing the skills needed for effective teaching in the digital age.

The integration of Virtual Learning Platforms (VLPs) such as Moodle, Edmodo, Canvas, Blackboard, Google Classroom, Cousera and Udemy in higher education represents a fundamental shift in how universities deliver educational content and engage with students. As academic institutions evolve from conventional classroom-based instruction to dynamic digital learning environments, the adoption of advanced educational technologies becomes essential. The integration of cutting-edge educational technology is crucial for enhancing teaching effectiveness, optimizing student engagement, and expanding access to education. This is further emphasized by Loglo (2024) that without adopting digital innovations such as VLPs, universities risk falling out of alignment with contemporary teaching practices and the evolving demands of 21st-century education. In an era where students expect flexible and technology-enhanced learning experiences, universities must leverage VLPs to remain relevant and effective in fulfilling their educational missions.

Zamora-Antuñano et al. (2021) emphasize that VLPs have begun to transform teaching practices, with applications ranging from basic content delivery to sophisticated interactive learning experiences. For instance, many universities use VLPs to facilitate blended learning approaches, incorporating features such as video lectures, interactive assessments, and collaborative learning tools (Jethwani et al., 2024). These innovations not only streamline course delivery but also enable instructors to focus on higher-order teaching activities. Adera (2025) indicates that such interactions can transform the traditional classroom into a more dynamic space where students feel supported in their learning journey. For example, VLPs can help to track student progress, identify areas of difficulty, and recommend additional resources based on individual learning patterns, thereby personalizing the educational experience (Moon et al., 2024). According to Pinto et al. (2023), emphasis that lecturers often express reservations about the benefits of these technologies due to limited 4IR- skills and technological proficiency. Many educators may have concerns about the reliability of virtual platforms or fear that technology could diminish the interpersonal aspects of teaching.

Additionally, institutional constraints and inadequate digital infrastructure pose significant challenges (Ndibalema, 2022). Researchers have called for the establishment of ethical guidelines concerning the use of VLPs in higher education to ensure responsible implementation and inclusive access (Zamora-Antuñano et al., 2021). For example, it is crucial to consider how student data collected through VLPs will be used and protected against unauthorized access or misuse. Additionally, universities must engage in discussions about the potential impact on teaching quality and student engagement. While VLPs can enhance course delivery, there remains a need for skilled educators who can provide nuanced guidance and facilitate meaningful learning experiences. Akram et al. (2021) recommend that universities develop comprehensive strategies for adopting technology that consider both technical requirements and pedagogical needs.

To successfully integrate VLPs, collaboration among various stakeholders is essential (Barrane et al., 2021). This collaboration can facilitate access to necessary resources and expertise while fostering open communication between administration and faculty regarding the acceptance and use of VLPs. Turnbull et

al. (2021) stated that Partnerships with educational technology providers can provide universities with insights into best practices for implementing and maintaining virtual learning systems. By engaging stakeholders across different levels, administrators, lecturers, IT staff, and students, universities can create comprehensive strategies that address both pedagogical needs and technological requirements. As VLPs become more integrated into university teaching, the role of lecturers is also evolving. Rather than replacing traditional teaching methods entirely, VLPs are redefining pedagogical approaches by facilitating blended learning environments, allowing educators to focus on higher-order teaching activities such as mentoring and facilitating deeper learning experiences (Zamora-Antuñano et al., 2021; Sølvik & Glenna, 2022).

This shift presents an opportunity for lecturers to enhance their professional skills through training programs focused on digital pedagogy and 4IR-Skill development. By embracing this evolution rather than resisting it, educators can position themselves as effective facilitators of knowledge in an increasingly digital learning environment. Building trust in VLP systems is also crucial for successful implementation within universities (Turnbull et al., 2021). To foster this trust relationship effectively requires transparency regarding how these platforms operate, particularly concerning data collection practices and addressing any concerns faculty may have about privacy or reliability. Higher education should actively engage lecturers through demonstrations showcasing VLP capabilities while soliciting feedback on their experiences; this participatory approach will help build confidence among educators while ensuring continuous improvement based on real-world usage patterns. The field of educational technology and VLPs continues to evolve rapidly; thus, ongoing research into new applications and challenges associated with these platforms is necessary.

Methodology

This study adopted a descriptive research design of the cross-sectional survey type to investigate lecturers' 4IR skills and their use of Virtual Learning Platforms (VLPs) for teaching in universities within Kwara State. The design is considered appropriate because it enables the researcher to describe and interpret existing conditions without manipulating variables. The population of the study comprises lecturers in universities across Kwara State, from which three institutions, a federal, a state, and a private university purposively selected to reflect ownership diversity and accessibility. A sample of total of 50 lecturers were randomly drawn as this this is pilot study "Questionnaire on the Lecturers' 4IR Skills and Use of Virtual Learning Platforms for Teaching in Universities in Kwara State" (QL4SUVLPTUKS), which consist of three sections: demographic information, assessment of lecturers' 4IR skills (proficiency with advanced technology, technical self-efficacy, and adaptability) in four Likert scale (SD-SA), and lecturers' use of VLPs measured on a yes and no scale.

To ensure the validity and reliability of the instrument, the instrument was given to experts for review of the content for clarity, accuracy, and relevance, while a pilot study involving 20 lecturers from two universities outside the main study area was conducted. Feedback from the pilot guides necessary modifications, and internal consistency was tested using Cronbach's Alpha, with a reliability coefficient of 0.74 considered acceptable. For data collection, approval was sought from selected universities, and consent was obtained from lecturers before administering the instrument through Google Forms shared via institutional emails and social media platforms. Data gathered was analysed using descriptive statistics such as frequencies, percentages for demographic information, mean was used to answer the research questions, while inferential statistics (independent sample t-test and linear regression) was employed to test the hypotheses at a 0.05 level of significance.

Analysis of Result

The collected data were interpreted and presented as follows:

Demographic Information of Respondents

Table 1
Distribution of Respondents by Gender

Gender	Frequency	Percent
Male	30	60.0
Female	20	40.0

Figure 1:
Pie-chart showing the distribution of respondents based on Gender

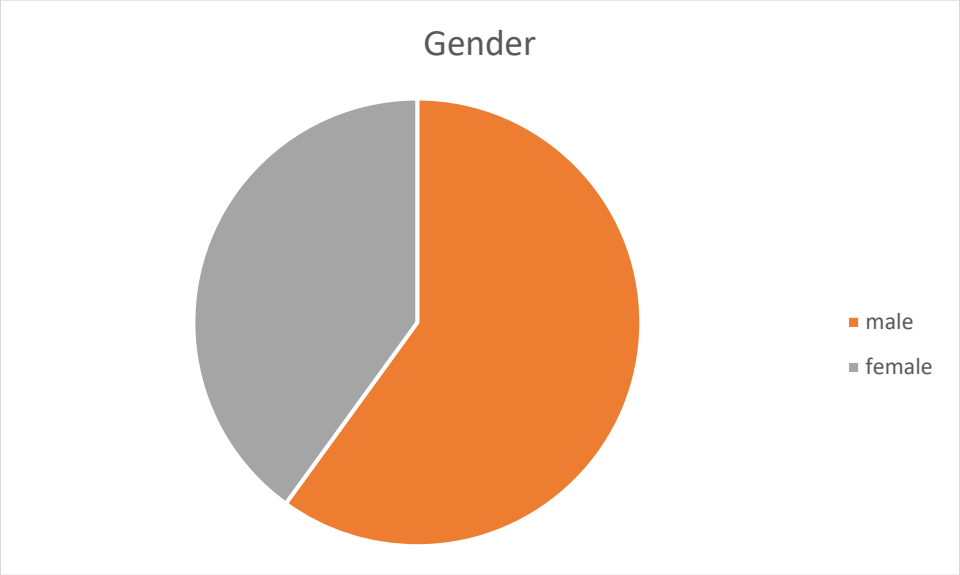

Table 1 presents the gender distribution of university lecturers in Kwara State who participated in the study and responded to the questionnaire used. Out of the 50 respondents, 30 lecturers (60%) are male, while 20 lecturers (40%) are female. The pie chart in Figure 1 also reinforces these data. This indicates that male lecturers constitute the majority of the sample, suggesting a gender imbalance in the academic workforce, with males being more represented than females among university lecturers in the study area.

Answering of Research Questions
Research Question One: What are the virtual learning platforms university lecturers use for teaching?
Table 2
University Lecturers' Utilisation of Virtual Learning Platforms

S/N	Items	Mean
1.	Google Classroom	1.91
2.	Moodle	1.57
3.	Edmodo	1.34

4.	Canvas	1.47
5.	Schoology	1.49
6.	Google Meet	1.70
7.	Zoom	1.72
8.	WhatsApp	1.76
9.	Telegram	1.59
10.	Microsoft Teams	1.50
	Grand Mean	1.61

Table 2 shows university lecturers' use of various virtual learning platforms (VLPs) for teaching. Using a mean threshold of 1.5 and above indicates usage, while values below 1.5 indicate non-use. It can be observed that Google Classroom (1.91), Moodle (1.57), Google Meet (1.70), Zoom (1.72), WhatsApp (1.76), Telegram (1.59), and Microsoft Teams (1.50) are actively used by lecturers for instructional purposes. Conversely, Edmodo (1.34), Canvas (1.47), and Schoology (1.49) fall below the threshold, suggesting that these platforms are rarely used for teaching. The grand mean of 1.61 indicates that, overall, lecturers demonstrate a moderate level of engagement with virtual learning platforms, favouring a few widely accessible and familiar tools for teaching.

Research Question Two: What 4IR-skills university lecturers possess for teaching?

Table 3

University Lecturers' 4IR-skills for Teaching

	Items	Mean
	Proficiency with Advanced Technology	
1.	I am proficient in using Artificial Intelligence (AI) tools for instructional purposes.	3.29
2.	I can effectively use data analytics tools to monitor students' learning progress.	3.19
	Technical Self-Efficacy	
3.	I am confident in my ability to learn new digital teaching tools independently.	3.41
4.	I believe I can successfully use any new virtual platform introduced by my institution.	3.39
5.	I feel competent in handling complex digital tools for instructional activities.	3.30
	Adaptability and Lifelong Learning	
6.	I actively seek opportunities to update my knowledge of digital teaching tools.	3.41
7.	I regularly participate in professional development programs related to digital skills.	3.33
8.	I am open to learning about emerging technologies in the education sector.	3.45
	Grand Mean	3.35

The data in Table 3 show the 4IR-skills possessed by university lecturers for teaching, using a mean scale where 2.5 and above indicates possession of the skill and below 2.5 indicates lack of the skill. Across the three dimensions, lecturers demonstrate competence in the relevant 4IR-skills. In the area of proficiency with advanced technology, means of 3.29 and 3.19 suggest that lecturers are able to use AI and data analytics tools effectively for instructional purposes. For technical self-efficacy, means ranging from 3.41, 3.39 and 3.30 indicate that lecturers feel confident in learning and applying new digital teaching tools independently and can handle complex instructional technologies. In the domain of adaptability and lifelong learning, means of 3.41, 3.33 and 3.45 show that lecturers actively seek professional development, update their digital knowledge, and remain open to emerging educational technologies. The grand mean of 3.35 indicates that, overall, lecturers possess the necessary 4IR-skills to support effective teaching in virtual environments.

Hypotheses Testing

The following hypotheses were tested at a 0.05 level of significance:

H_{01}: There is no significant difference between male and female university lecturers' 4IR-skills in Kwara State.

Table 4

Independent t-test Analysis Showing the Difference between Male and Female University Lecturers' 4IR-Skills in Kwara State

	Gender	N	Mean	df	T	Sig. (2-tailed)
Lecturers' 4IR-skills	Male	30	1.50	48	0.00	1.000
	Female	20	1.25			

Table 4 shows that there is no significant difference between male and female university lecturers' 4IR-skills in Kwara State. The mean score for male lecturers (Mean = 1.50) is slightly higher than that of female lecturers (Mean = 1.25). However, the t-value obtained is 0.000 with a significance level (p-value) of 1.000, which is greater than the 0.05 level of significance. This indicates that the observed difference in mean scores is not statistically significant. Therefore, the null hypothesis (H_{01}), which states that there is no significant difference between male and female university lecturers' 4IR-skills in Kwara State, is accepted. This implies that gender does not influence lecturers' possession of 4IR-skills in the study area.

H_{02}: There is no significant influence on university lecturers' 4IR-skills on their use of VLPs for teaching in Kwara State

Table 5

Regression Analysis of the Influence of University Lecturers' 4IR Skills on Their Use of Virtual Learning Platforms

Model	Unstandardized Coefficients	Standardized Coefficients	T	p
	B	Std. Error	Beta	
1				
Constant	2.857	0.804	–	3.554
University lecturers' 4IR-skills	-0.429	0.583	-0.251	-0.735

Note. Dependent variable = Use of virtual learning platforms (VLPs).

The results presented in Table 5 indicate that university lecturers' 4IR skills do not have a statistically significant influence on their use of virtual learning platforms for teaching in Kwara State. Specifically, the regression coefficient for lecturers' 4IR skills is negative (B = -0.429) with a standardized beta of -0.251, suggesting a weak negative relationship; however, this relationship is not statistically significant ($t = -0.735$, $p = 0.483$, $p > 0.05$). The constant term (B = 2.857, $t = 3.554$, $p = 0.007$) represents the baseline level of VLP use when lecturers' 4IR skills are zero. Overall, these findings support the null hypothesis (H_02), indicating that while lecturers may possess 4IR competencies, these skills alone do not significantly predict or influence their actual use of virtual learning platforms in teaching

Summary of the Findings

The following is a summary of findings based on the interpreted data:

1. University lecturers in Kwara State moderately utilise virtual learning platforms for teaching, with greater reliance on widely accessible tools such as Google Classroom, Google Meet, Zoom, WhatsApp, Telegram, and Microsoft Teams, while platforms like Edmodo, Canvas, and Schoology are underutilised.
2. University lecturers in Kwara State possess high levels of 4IR skills, particularly in digital literacy and critical thinking, which enhance their teaching effectiveness.
3. There is no significant difference between male and female university lecturers' 4IR skills in Kwara State.
4. lecturers' 4IR skills do not significantly influence their use of virtual learning platforms for teaching in Kwara State, as indicated by a negative but non-significant coefficient.

Discussion

The findings of this study indicate that university lecturers in Kwara State moderately utilise virtual learning platforms (VLPs) for teaching, showing greater reliance on widely accessible tools such as Google Classroom, Google Meet, Zoom, WhatsApp, Telegram, and Microsoft Teams, while platforms like Edmodo, Canvas, and Schoology remain underutilised. This observation aligns with the work of Zamora-Antuñano et al. (2021) and Jethwani et al. (2024), who noted that although VLPs have the potential to transform teaching practices, educators often favour familiar and readily available platforms over more specialized or sophisticated systems. The preference for widely accessible tools can be attributed to their ease of use, familiarity, and lower learning curve, as well as existing infrastructural support, reflecting the need for universities to provide targeted training and resources to encourage the adoption of a broader range of virtual learning technologies (Akram et al., 2021; Barrane et al., 2021).

The study also found that university lecturers in Kwara State possess high levels of 4IR skills, particularly in digital literacy and critical thinking, which contribute to teaching effectiveness. This supports the arguments of Olaitan et al. (2024) and Rana et al. (2024), who emphasised that 4IR skills, including digital pedagogy, virtual content creation, and learning analytics, enable lecturers to navigate the evolving technological landscape effectively. Such competencies are critical in transforming lecturers from traditional content deliverers into digital facilitators and experience designers capable of leveraging technology-enhanced environments to foster interactive and personalised learning. Similarly, Kalyani (2024) and Yusuf et al. (2022) highlight that the integration of ICT and emerging technologies facilitates student-centred learning and promotes essential 21st-century skills, suggesting that lecturers' proficiency in 4IR competencies is instrumental in aligning instructional strategies with modern pedagogical demands.

Interestingly, the findings revealed no significant gender difference in lecturers' 4IR skills in Kwara State. This observation resonates with studies by Ibegbulam et al. (2023) and Wafula (2025), which indicate that access to digital tools and professional development opportunities can mitigate gender-based disparities in technological competencies. The absence of significant gender differences may reflect the equitable distribution of professional training, exposure to ICT resources, and institutional support within higher education institutions in the region, emphasising the importance of inclusive policies and continuous skills development in fostering technology adoption.

However, despite high levels of 4IR skills among lecturers, the study found that these competencies do not significantly influence the use of VLPs. This finding aligns with the concerns raised by Pinto et al. (2023) and Ndibalema (2022), who argued that technological proficiency alone is insufficient to guarantee

effective adoption of virtual learning tools. Factors such as institutional constraints, inadequate digital infrastructure, lack of technical support, and personal attitudes toward technology play significant roles in determining the actual use of VLPs. Moreover, as Turnbull et al. (2021) and Loglo (2024) noted, successful integration of VLPs requires not only technical skills but also active engagement with platform capabilities, trust in digital systems, and alignment with pedagogical objectives. This indicates that while 4IR skills equip lecturers with the necessary competencies to interact with technology, complementary institutional support and strategic adoption frameworks are critical for translating these skills into effective VLP utilisation.

Conclusion

The study concluded that while university lecturers in Kwara State possess high levels of 4IR skills, particularly in digital literacy and critical thinking, these competencies alone do not significantly determine the extent of their use of virtual learning platforms. Lecturers demonstrate moderate engagement with widely accessible tools such as Google Classroom, Zoom, and WhatsApp, whereas specialised platforms like Edmodo, Canvas, and Schoology remain underutilised. The absence of significant gender differences in 4IR skills suggests equitable access to digital resources and training opportunities across male and female lecturers. However, the weak influence of 4IR-skills on VLP usage highlights that technological competence must be supported by adequate institutional infrastructure, targeted training, and motivational strategies to enhance adoption.

Recommendation

The following recommendations were made based on the findings of the study:

1. Universities should provide targeted training and support to encourage lecturers to adopt a wider range of virtual learning platforms, including underutilised tools like Edmodo, Canvas, and Schoology.
2. Institutions should sustain and expand professional development programs to further strengthen lecturers' 4IR competencies and ensure continuous improvement in digital teaching practices.
3. Universities should maintain equitable access to ICT resources and training for all lecturers, ensuring inclusive opportunities regardless of gender.
4. Policymakers and administrators should complement skill development with improved digital infrastructure, institutional support, and strategies to motivate lecturers to actively integrate virtual learning platforms into teaching.

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