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An Online Survey of Science Educators' Challenges of Implementing Digital Pedagogy in Public Universities in Kogi State, Nigeria

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Abstract

This study explored an online survey of science educators' challenges of implementing digital pedagogy in public universities in Kogi State, Nigeria. The population of this study consists of 52 science educators in the four public universities in Kogi State, Nigeria. There was no sampling since the population was manageable. The study adopted a descriptive survey research design. An online google form survey questionnaire titled Challenges of Implementing Digital Pedagogy Questionnaire (CIDPQ) was the instrument used for data collection. CIDPQ was trial tested which yielded a reliability value of 0.88 using Cronbach Alpha. The CIDPQ contained 22-items. Two research questions and two null hypotheses guided the study. The research questions were answered using mean and standard deviation scores while the null hypotheses were tested at 0.05 level of significance using t-test statistics. The study revealed that there is no significant difference between the mean ratings of male and female science educators on challenges of implementing digital pedagogy ($t=1.89$, $df=50$, $P>0.05$). There was no significant difference between the mean ratings of male and female science educators on measures that could address the challenges of implementing digital pedagogy ($t=1.76$, $df=50$, $P>0.05$). Thus, there is need for universities administrators and other relevant educational stakeholders to provide sufficient and accessible ICT resources and provide continuous professional development on how to effectively implement digital pedagogy.

Keywords: science educators, digital pedagogy and public universities

1. Introduction

In the age of digital transformation, education is at a historic crossroads. The concept of digital pedagogy is no longer a mere trend but has become a fundamental necessity for modern education systems. Though, digital pedagogy doesn't supersede fundamental educational merits but rather boost and modernize them, standardizing teaching methods with the realities of the digital age and meeting the needs for "digital native" generations. Digital pedagogy completely redefines the teaching and

learning, assessment practices, integrating digital not only as an auxiliary tool, but as central elements of a new educational philosophy. In other words, digital pedagogy is an emerging philosophy of teaching which combines the carefully curated use of technology with evidence-based strategies to achieve excellence in learning and teaching. The transformation from traditional methods to digital pedagogy marks a revolution that transcends the mere use of technology, aiming at a profound transformation in the way we think about learning and skills development in the 21st century (Vaataja & Ruokamo, 2021).

Technology has influenced a lot on learning and resulted in the development of digital pedagogy, which has become a vital part of today's world. Digital pedagogy encompasses the integration and utilization of technology to improve and enrich the learning experience. It is the thoughtful integration of digital tools, environments and strategies into teaching and learning process for effective instructional delivery (Waddell & Clariza, 2018). It may be applied to online, hybrid, and face-to-face learning (Tapscott, 2009). Digital pedagogy is the study of how digital technologies can be optimally used in teaching and learning (Joint Information System Committee, 2021). It can include the educational aspects of various digital applications and tools, virtual teaching and learning assistants and digital competences of teachers. Thus, science educators are required to be more creative and innovative in preparing students to face the challenges of 21st century through quality teaching and learning. Teaching and learning quality can be improved through digital pedagogy. Digital pedagogy is crucial due to the fact that it enhances personalized learning by tailoring instruction to meet individual students' unique needs and learning styles and it is also crucial for developing students with digital competencies needed for both academic success and future employability (Ajayi, Ameh, & Negedu, 2025).

Pedagogy is a teaching method, and it is adopted by a teacher, which involves teaching styles, theory, assessment and feedback. Teaching always involves the concept of design which includes planning course content, methods and modes of teaching. Digital pedagogy is the study of how to teach using digital technologies (Howell, 2013). Digital pedagogy focuses on the use of technology tools to breakdown learning barriers and enhance students' learning experiences. There are many digital pedagogy tools that facilitate activities such as interactive lessons, digital assessments, and collaborative lessons aiming to engage students and enhance their learning experience by integrating technology. The digital pedagogy tools encompass a wide range of software, hardware, and digital resources used to improve teaching and learning through technology, including learning management systems (LMS), interactive presentation tools (such as Prezi, Mentimeter, PowerPoint, Visme, Nearpod, Google slides and Pear Deck), collaborative platforms (Slack, Padlet, Mural, Miro, google workspace), content creation software (video editing, canvas, e-books) and immersive technologies such as augmented and virtual reality (AR/VR). Thus, implementing digital pedagogy brings substantial benefits for students, transforming their educational experience in multiple dimensions such as active engagement and personalized learning.

Implementing digital pedagogy requires aligning technological tools with student-centered, socio-constructivist strategies to learning to enhance engagement and skill development. Thus, science educators are expected to integrate technology into their lessons to foster digital literacy, create interactive, personalized learning paths and meaningful learning experiences. Ajayi, Ameh, and Alabi (2025) opine that science educators can leverage technology tools (such as online simulation, mini-videos and educational software) to enhance students learning. Thus, the importance of science educators' responsibilities in implementing digital pedagogy cannot be overstated. The researchers observed that science educators in public universities in Kogi State are making efforts in implementing digital pedagogy. However, despite these efforts of science educators to equip students with the quality education necessary to navigate and address global challenges effectively. Yet, there are a number of challenges that need to be addressed in order to realize fully the anticipated benefits of these efforts. Kane and Staiger (2017) found that teachers score lowest on complex teaching abilities such as using technology means to communicate with students about subject. A study by Chen (2018) revealed that some teachers lack the necessary abilities and competences to apply technology effectively in the learning process. Ajayi and Audu (2023) opines that the abrupt emergence of COVID-19 at the end of 2019,

the performance of teachers in providing quality education has been significantly diminished due to their inability to effectively implement digital pedagogy.

A study by Delgado (2022), revealed that teachers face a multitude of challenges when integrating technology to classroom learning in grade 3 class in Thailand, which include poor technical support, poor internet access, excessive work, and inadequate technology pedagogical knowledge. A study by Mokhele (2024) concluded that teachers' inability to develop and use technology-supported instructions, and inadequate staff development training hindered the implementation of smart technology in High Schools in South Africa. However, there is scarcity of studies on science educators' challenges of implementing digital pedagogy. Gender has to do with socially constructed differences which lead to forms of inequality (Penda, 2024). Gender is one of the factors that could influence science educator's ability to implement digital pedagogy. Differences in characteristics, attitudes, and abilities by male and female science educations could influence science educator's ability to implement digital pedagogy. Thus, the study explored an online survey of science educators' challenges of implementing digital pedagogy with respect to gender in public universities in Kogi State, Nigeria.

1.1 Purpose of the Study

The purpose of this study was on an online survey of science educators' challenges of implementing digital pedagogy in public universities in Kogi State, Nigeria. Specifically, the study:

1) ascertain the science educators' challenges of implementing digital pedagogy in public universities; and
2) determine the measures that could address the challenges of implementing digital pedagogy in public universities.

1.2 Research Questions

The following research questions guided this study:

1) What are the science educators' challenges of implementing digital pedagogy in public universities?
2) What are the measures that could address the challenges of implementing digital pedagogy in public universities?

1.3 Hypotheses

The following null hypotheses were tested:

1) There is no significance difference between the mean rating of male and female science educators on challenges of implementing digital pedagogy in public universities.
2) There is no significance difference between the mean rating of male and female science educators on measures that could address the challenges of implementing digital pedagogy in public universities.

2. Methodology

The study adopted a descriptive survey design. This design was adopted because it is a design in which a group of people or items are studied by collecting and analyzing data from only a few people or items considered to be representative of the entire group. The study area was of Kogi State, Nigeria. Kogi State is a state in the North Central region of Nigeria. The target population for this study comprises all the 52 science educators in the four public universities in Kogi State, Nigeria. The public universities are Prince Abubakar Audu University Anyigba (PAAU), Confluence University of Science and Technology Osara (CUSTECH), Kogi State University Kabba (KSU) and Federal University Lokoja (FUL). In this study, Science educators are lecturers or professional teachers who teaches science education subjects such as biology, chemistry, physics, integrated science, computer science, and mathematics in public universities in Kogi State, Nigeria. There was no sample size due to the fact that the population size involved was small and easily accessible, it was feasible to collect data from every science educator especially with the use of online google form survey questionnaire, making sampling unnecessary.

An online google form survey questionnaire titled Challenges of Implementing Digital Pedagogy Questionnaire (CIDPQ) was the instrument used for data collection. CIDPQ contained two sections. Section "A" contained demographic information of the respondents, while section "B" contained a 24-item questionnaire which is intended to help lecturers express their opinions on the challenges of implementing digital pedagogy and their opinions on measures that could address the challenges of implementing digital pedagogy. Each of the items is a 4-point Likert-rating scale with 4 response options. The options are Strongly

Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD). CIDPQ is a 4 Likert scale with number indicators as 4 (Strongly Agree), 3 (Agree), 2 (Disagree) and 1(Strongly Disagree).

The online google form survey questionnaire was face validated by two experts in Science Education/Measurement and Evaluation in the department of Science Education, Prince Abubakar Audu University Anyigba and an expert in Science Education in the department of Science Education, Federal University Lokoja. The items were scrutinized by these expects. The instrument was review based on the experts' corrections and suggestions. The online google form survey questionnaire was trial-tested to establish the reliability coefficient which yielded 0.88 using Cronbach Alpha. Thus, online google form survey questionnaire was used for data collection. The online google form survey questionnaire was administered to respondents through email addresses/WhatsApp phone nos. by the researchers. A total of 52 copies of the online google form survey questionnaire was responded to by the science educators and the data collected were analysed. Mean and Standard deviation scores were used to answer the research questions, while the null hypotheses were tested at 0.05 level of significance using independent t-test. The online google form survey questionnaire were sorted by gender, and the differences in mean rating were obtained.

3. Results

Presentations in this section are based on research question and null hypotheses.

3.1 Research Question One

What are the science educators' challenges of implementing digital pedagogy in public universities? The answer to research question one is presented on Table 1 and Figure 1 respectively.

Table 1. Mean Rating of Science Educators' Challenges of Implementing Digital Pedagogy

S/N	Item(s)	Mean $\bar{x}$	Std.dev δ	Remark
1.	Inadequate access to technology tools and reliable internet is one of the challenges of implementing digital pedagogy.	3.83	0.31	Positive
2.	Incompetency of lecturers to use ICT tools is one of the challenges of implementing digital pedagogy.	3.17	0.19	Positive
3.	Insufficient exposure to professional training on how to effectively integrate technology into classroom teaching is one of the challenges of implementing digital pedagogy.	3.74	0.27	Positive
4.	Inadequate commitment to develop and use technology-supported instructions is one of the challenges of implementing digital pedagogy.	3.46	0.23	Positive
5.	Insufficient ICT unit technical support is one of the challenges of implementing digital pedagogy.	3.22	0.20	Positive
6.	Time constraints is one of the challenges of implementing digital pedagogy.	3.56	0.25	Positive
7.	Excessive workload is one of the challenges of implementing digital pedagogy.	3.41	0.21	Positive
8.	Inadequate laboratory equipment and other resources is one of the challenges of implementing digital pedagogy.	3.66	0.27	Positive
9.	Inadequate planning time to design digital pedagogy is one of the challenges of implementing digital pedagogy.	3.64	0.23	Positive
10.	Inadequate commitment to develop and use valid digital assessment practices is one of the challenges of implementing digital pedagogy.	3.44	0.21	Positive
11.	Inadequate of motivation (incentives) and irregular payment of salaries is one of the challenges of implementing digital pedagogy.	3.86	0.27	Positive

Total	38.99	2.64	
Cluster Mean & Std. Dev.	**3.54**	**0.24**	**Positive**

Source: Online Survey, 2025.

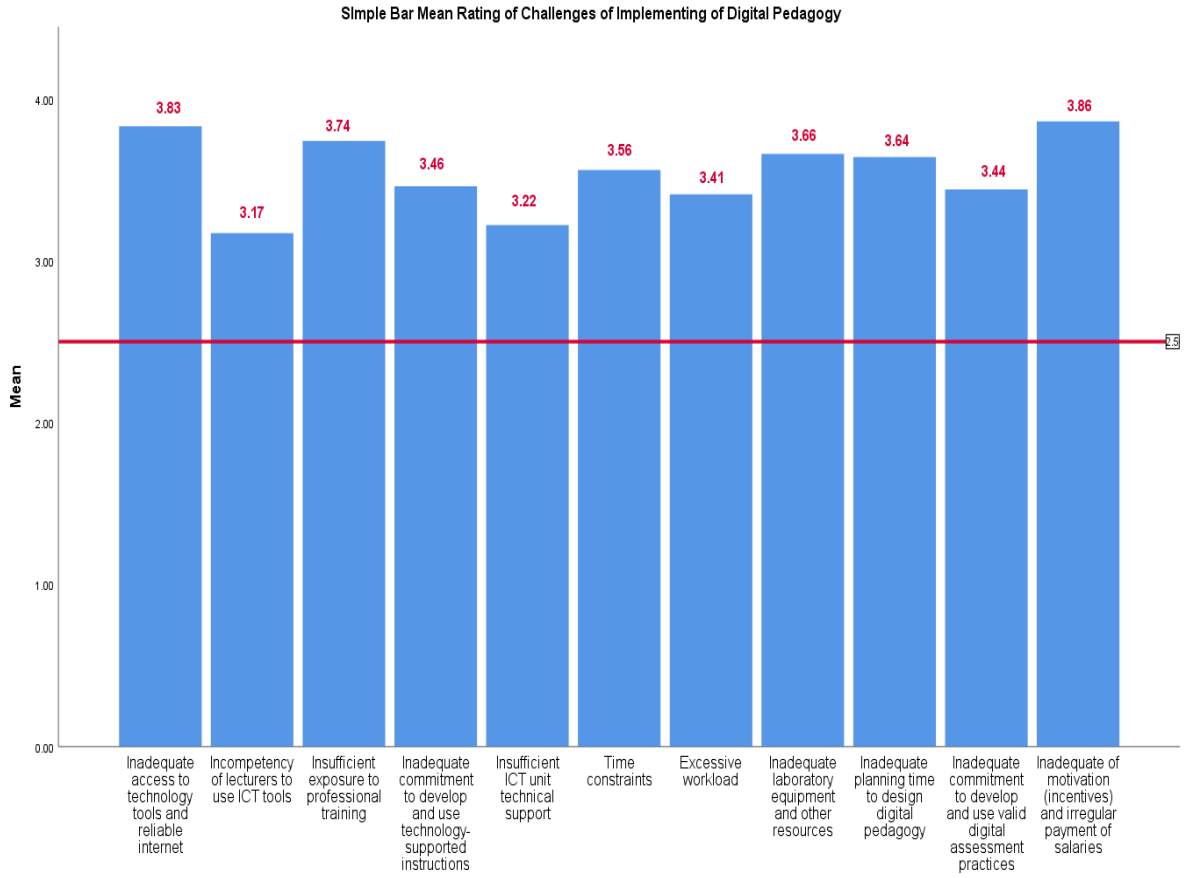

Figure 1. Bar Chart of Mean Rating of Science Educators' Challenges of Implementing Digital Pedagogy

The summary of the mean ratings of science educators' challenges of implementing digital pedagogy in public universities in Kogi State, Nigeria is represented in Figure 1. Figure shows that, the responses of science educators on all the eleven items on challenges of implementing digital pedagogy was above cut-off point of 2.50. The data in Table 1 show that, the responses of science educators on all the eleven items on challenges of implementing digital pedagogy were positive, giving a cluster mean responses of 3.54 which is positive. This implies that all the mentioned areas are the science educators' challenges of implementing digital pedagogy in public universities in Kogi State, Nigeria.

3.2 Research Question Two

What are the measures that could address the challenges of implementing digital pedagogy in public universities? The answer to research question two is presented on Table 2.

Table 2. Mean Rating of Measures that could address the Science Educators' Challenges of Implementing Digital Pedagogy

S/N	Item(s)	Mean x	Std.dev δ	Remark
1.	Adequate access to technology tools and reliable internet will address the challenges of implementing digital pedagogy	3.57	0.22	Positive

2.	High proficiency of lecturers on the use ICT tools will address the challenges of implementing digital pedagogy	3.79	0.31	Positive
3.	Continuous professional training on how to effectively integrate technology into classroom teaching will address the challenges of implementing digital pedagogy	3.81	0.34	Positive
4.	Adequate commitment to develop and use technology-supported instructions will address the challenges of implementing digital pedagogy	3.56	0.25	Positive
5.	Sufficient ICT unit technical support will address the challenges of implementing digital pedagogy	3.33	0.22	Positive
6.	Allocation of adequate lecture time will address the challenges of implementing digital pedagogy	3.45	0.29	Positive
7.	Encouraging universities administrators to adopt a maximum of 8-12 credit hours per week per semester workload as recommended by National Universities Commission (NUC) will address the challenges of implementing digital pedagogy	3.62	0.28	Positive
8.	Adequate provision of infrastructure and resources (laboratory equipment and technology tools) to support hands-on learning will address the challenges of implementing digital pedagogy	3.53	0.25	Positive
9.	Encouraging science educators to create time to design digital pedagogy will address the challenges of implementing digital pedagogy	3.41	0.23	Positive
10.	Adequate commitment to develop and use valid digital assessment practices will address the challenges of implementing digital pedagogy	3.43	0.23	Positive
11.	Provision of adequate motivation (incentives) and regular payment of salaries will address the challenges of implementing digital pedagogy	3.71	0.29	Positive
	Total	42.17	2.77	
	Cluster Mean & Std. Dev.	**3.51**	**0.23**	**Positive**

Source: Online Survey, 2025.

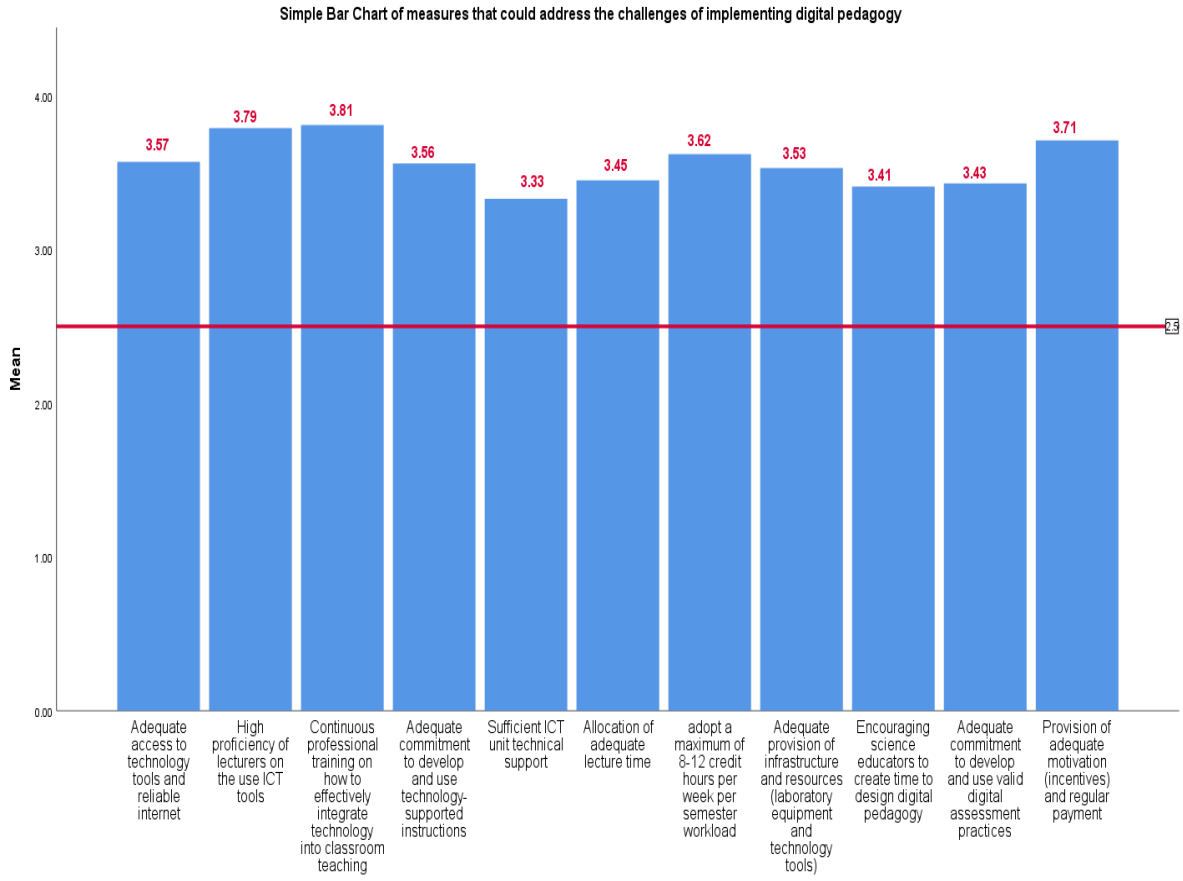

Figure 2. Bar Chart of Mean Rating of measures that could address the science educators' challenges of implementing digital pedagogy

The summary of the mean ratings of the measures that could address the science educators' challenges of implementing digital pedagogy in public universities in Kogi State, Nigeria is represented in Figure 2. Figure shows that, the responses of science educators on all the eleven items on the measures that could address the science educators' challenges of implementing digital pedagogy was above cut-off point of 2.50. The data in table 2 show that, the responses of science educators on all the eleven items on the measures that could address the science educators' challenges of implementing digital pedagogy were positive, giving a cluster mean responses of 3.54 which is positive. This implies that all the mentioned areas are measures that could address the science educators' challenges of implementing digital pedagogy in public universities in Kogi State.

Hypothesis One

There is no significance difference between the mean rating of male and female science educators on challenges of implementing digital pedagogy. The test for hypothesis one is presented on Table 3.

Table 3. t-test of Mean Rating of Male and Female Science educators on Challenges of Implementing Digital pedagogy

Sex	*N*	Mean x	Std.dev δ	*t*	*df*	*p-value*	*level of significant*	*decision*
Male	28	3.78	0.31					
				1.89	50	.223	0.05	NR
Female	24	3.71	0.29					

Source: Online Survey, 2025; NR= Not Rejected.

Table 3 presents the summary of t-test analysis of mean rating of male and female science educators on challenges of implementing digital pedagogy in public universities in Nigeria. The t-test result reveals that there is no significant difference between the mean ratings of male and female science educators on challenges of implementing digital pedagogy (t=1.89, df=50, P>0.05). The null hypothesis is therefore not rejected. This implies that there is no significance difference between the mean rating of male and female science educators on challenges of implementing digital pedagogy in public universities in Kogi State, Nigeria.

Hypothesis Two

There is no significance difference between the mean rating of male and female science educators on measures that could address the challenges of implementing digital pedagogy. The test for hypothesis two is presented on Table 4.

Table 4. t-test of Mean Rating of Male and Female Science educators on Measures that could address the Challenges of Implementing Digital pedagogy

Sex	*N*	Mean x	Std.dev δ	t	df	*p-value*	*level of significant*	*decision*
Male	28	3.82	0.30					
				1.76	50	.323	0.05	NR
Female	24	3.69	0.27					

Source: Online Survey, 2025; NR= Not Rejected.

Table 4 presents the summary of t-test analysis of mean rating of male and female science educators on measures that could address the challenges of implementing digital pedagogy in public universities in Nigeria. The t-test result reveals that there is no significant difference between the mean ratings of male and female science educators on measures that could address the challenges of implementing digital pedagogy (t=1.76, df=50, P>0.05). The null hypothesis is therefore not rejected. This implies that there is no significance difference between the mean rating of male and female science educators on measures that could address the challenges of implementing digital pedagogy in public universities in Kogi State, Nigeria.

4. Discussion of Findings

The study was on an online survey of science educators' challenges of implementing digital pedagogy in public universities in Kogi State, Nigeria. The finding revealed that, there is no significance difference between the mean rating of male and female science educators on challenges of implementing digital pedagogy. This implies that both male and female science educators' opinions on the challenges of implementing digital pedagogy are the same irrespective of gender. Thus, it was concluded that the science educators' challenges of implementing digital pedagogy are; Inadequate access to technology tools and reliable internet, Incompetency of lecturers to use ICT tools, insufficient exposure to professional training on how to effectively integrate technology into classroom teaching, inadequate commitment to develop and use technology-supported instructions, insufficient ICT unit technical support, time constraints, excessive workload, inadequate laboratory equipment and other resources, inadequate planning time to design digital pedagogy, inadequate commitment to develop and use valid digital assessment practices, and inadequate of motivation (incentives) and irregular payment of salaries. This finding agrees with Delgado (2022) who revealed that teachers face a multitude of challenges such as poor technical support, poor internet access, excessive work, and inadequate technology pedagogical knowledge when integrating technology to classroom learning in grade 3 class in Thailand. This finding also agrees with Mokhele (2024) who concluded that teachers' inability to develop and use technology-supported instructions, and inadequate staff development training hindered the implementation of smart technology in High Schools in South Africa. By implication, digital pedagogy brings in new opportunities and challenges for science educators while the traditional teaching method has been gradually losing and decreasing its lure.

The finding revealed that, there is no significance difference between the mean rating of male and

female science educators on measures that could address the challenges of implementing digital pedagogy in public universities in Kogi State, Nigeria. Thus, this implies that both male and female science educators' perceptions on the measures that could address the challenges of implementing digital pedagogy are the same irrespective of gender. Hence, it was concluded that adequate commitment to develop and use technology-supported instructions, high proficiency of lecturers on the use ICT tools, continuous professional training on how to effectively integrate technology into classroom teaching, adequate commitment to develop and use technology-supported instructions, sufficient ICT unit technical support, allocation of adequate lecture, encouraging universities administrators to adopt a maximum of 8-12 credit hours per week per semester workload as recommended by National Universities Commission (NUC), adequate provision of infrastructure and resources (laboratory equipment and technology tools) to support hands-on learning, encouraging science educators to create time to design digital pedagogy, adequate commitment to develop and use valid digital assessment practices, and provision of adequate motivation and regular payment of salaries are the measures that could address the challenges of implementing digital pedagogy in public universities in Kogi State, Nigeria.

5. Conclusion

It is evident from the findings of this study that no gender disparity exists in the perceptions of male and female science educators on the challenges of implementing digital pedagogy in public universities in Nigeria. This study has established that science educators' challenges of implementing digital pedagogy in public universities in Kogi State, Nigeria are inadequate access to technology tools and reliable internet, incompetency of lecturers to use ICT tools, insufficient exposure to professional training on how to effectively integrate technology into classroom teaching, inadequate commitment to develop and use technology-supported instructions and so on. In the same vein, no gender disparity exists in the opinions of male and female science educators in terms of the measures that could address the challenges of implementing digital pedagogy. Thus, to effectively implement digital pedagogy in public universities in Kogi State Nigeria, recommendations were made.

6. Recommendations

1) There is need for universities administrators and other educational stakeholders to provide sufficient access to technology tools and reliable internet to foster the implementation of digital pedagogy.
2) Universities administrators and other educational stakeholders should also ensure that lecturers have access continuous professional training on how to effectively integrate technology into classroom teaching to foster the implementation of digital pedagogy.
3) Educational stakeholders should ensure that science educators are encouraged to create time to design digital pedagogy and develop and use valid digital assessment practices to foster the implementation of digital pedagogy.
4) Universities administrators should ensure the universities ICT unit provide adequate technical support for science educators so as to ensure effective implementation of digital pedagogy.
5) Universities administrators and other educational stakeholders should ensure prompt payment of salaries to encourage their commitment to implement digital pedagogy.

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