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## Pre-Service Biology Teachers' Pedagogical Skills and Usability of Mobile Technology for Instructional Delivery During Teaching Practice

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### Abstract

The ease of using mobile technology for teaching is hindered by deficiencies in teacher training programs. This study aims to address this issue and explore solutions for improving the use of mobile technology in teaching in Nigeria, particularly focusing on how pre-service science teachers can acquire pedagogical skills through mobile technology during teaching practice. Using a descriptive research method of the survey type, the study addresses five research questions and tests two research hypotheses at a significance level of 0.05. The population comprises science education students in public and private institutions in Ilorin, with samples drawn randomly from three colleges of education in different local government areas. A total of 285 respondents participated, providing data through a researcher-designed questionnaire titled "Pre-service Teachers' Pedagogical Skills and Usability of Mobile Technology for Instructional Delivery Questionnaire (PTPSUMTIDQ)". Findings reveal a lack of technological literacy among classroom teachers in Nigeria, attributed to inadequate training. Mobile phones emerge as the most commonly used mobile technology device among teachers, and the study highlights the potential of mobile technology to help pre-service teachers acquire necessary pedagogical skills for successful careers in education. The paper recommends improving teacher training programs and providing education on the effective use of mobile technology to address these challenges.

## INTRODUCTION

Biology holds a pivotal place in scientific education, offering insights into the intricate world of living organisms. The American Association for the Advancement of Science [AAAS] (2010) asserts that human curiosity about the natural world has spurred an enduring interest in biology, driven by our dominion over all living things. Gorgeous (2013) defines biology as a branch of natural science dedicated to the study of life, encompassing its development, function, evolution, distribution, structure, and classification. Understanding biology involves not only acquiring a wealth of factual knowledge but also grasping the interconnectedness of these facts and their implications for human existence (Umar, 2011).

Martin and Robert (2015) elaborate on biology as the scientific exploration of living entities and physiological processes, highlighting diverse sub-disciplines such as zoology, botany, genetics, medicine, and ecology. Teachers trained in biology education assume a critical role in instructing students at the senior secondary level, serving as conduits between curriculum objectives and learners. Zincirili (2021) defines a teacher simply as an individual who imparts instruction, emphasizing the pivotal role of educators in facilitating students' educational journey.

The teaching profession, according to Adedeji and Bello (2016), involves the effective transmission of cognitive and psychomotor skills essential for various professions. Teachers, as affirmed by Ernest, Christopher, and Kofi (2019), are pivotal in bridging the gap between curricular goals and student learning outcomes. They are tasked with guiding students towards academic success while managing classroom dynamics to achieve instructional objectives (Gelisi, 2007). Despite this crucial role, the teaching profession has faced challenges, with Mavic (2020) noting a decline in the number of educators with a steadfast commitment to their vocation.

Within the realm of teacher education, individuals undergoing training to become educators are referred to as pre-service teachers (Zincirili, 2021). These aspiring educators represent the future of the teaching profession, undergoing rigorous preparation to assume their roles as educators. As such, understanding the pedagogical skills and technological competencies of pre-service biology teachers

becomes paramount for enhancing instructional delivery and fostering academic success.

During the teaching practice program, instructors encounter a variety of challenges, including issues related to instructional delivery, pedagogical skill development, and the integration of mobile technology. Nigeria, in its pursuit of the Vision 2020 agenda, has made concerted efforts to reshape educators' attitudes towards incorporating ICT into teaching and learning. Musa and Waheed (2013) attribute poor performance in Biology exams to factors such as students' lack of interest, the subject's content volume, and the absence of ICT integration in teaching and learning processes.

Teaching practice is a pivotal component of teacher preparation, offering hands-on experience in authentic teaching environments (Kiggundu & Nayimuli, 2009). Lukman (2023) underscores its significance in shaping teachers' perspectives and enhancing their professional growth. Exposure to classroom challenges during teaching practice boosts pre-service teachers' motivation to optimize their learning experiences (Kiggundu & Nayimuli, 2009).

Instructional delivery models encompass the methods employed by teachers to impart lesson material to students (Lukman, 2023). Knight (2012) emphasizes that effective instruction hinges on teachers' adeptness in employing diverse delivery strategies to maximize student learning outcomes. Hattie (2009) underscores the importance of active teacher engagement in managing dynamic learning environments, fostering effective student-teacher and student-content interactions.

Pedagogical abilities are paramount for future educators, encompassing skills in classroom management, subject mastery, student comprehension, and collaboration (Indeed Editorial Team, 2022). Bolaji (2023) highlights effective teaching techniques such as assessing prior knowledge, setting high expectations, and incorporating spaced repetition. Pedagogy, defined by Dew (2023), encompasses instructional methods aimed at optimizing student learning outcomes and facilitating deeper understanding through meaningful connections to research.

E-learning, as elucidated by Umar (2022), encompasses educational activities facilitated by technology, both within and beyond classroom settings. Mobile technology, a subset of e-learning, enables ubiquitous learning experiences, transcending temporal and spatial constraints (Trifonova & Ronchetti, 2008).

Afzalova (2012) highlights the transformative impact of mobile phones on education, facilitating individual and collaborative learning experiences. Aderinoye (2007) underscores the role of mobile phones in mobile learning, enhancing access to learning resources on the go. The integration of mobile technology into teaching practices remains an ongoing area of exploration (Sharples, 2003). However, existing research lacks comprehensive insights into pre-service teachers' utilization of mobile technologies during teaching practice. This study aims to investigate the pedagogical competencies of pre-service Biology instructors and the efficacy of mobile technology in educational delivery.

### **Purpose of the Study**

The primary objective of this study was to assess the classroom pedagogical abilities of pre-service biology instructors and the practicality of utilizing mobile technology for instructional delivery in teaching practices in Ilorin. The study specifically aimed to:

1. Examine the classroom pedagogical skills of pre-service biology teachers during their teaching practice in Ilorin, Kwara State, Nigeria.
2. Determine the awareness of mobile technology for instructional delivery in Ilorin, Kwara State, Nigeria.
3. Evaluate the usability of mobile technology for instructional delivery in Ilorin, Kwara State, Nigeria.
4. Investigate whether gender influences the acquisition of pedagogical skills by pre-service biology teachers during teaching practice.
5. Explore the influence of gender on the usability of mobile technology by pre-service biology teachers during teaching practice.

### **Research Questions**

The following questions were raised and answered:

1. What pedagogical skills do pre-service Biology teachers in Ilorin use during the teaching practice program?
2. What is the level of awareness of mobile technology for instructional delivery among pre-service Biology teachers in Ilorin, Kwara State, Nigeria?
3. What is the level of usability of mobile technology for instructional delivery as perceived by pre-service Biology teachers in Ilorin, Kwara State, Nigeria?

4. Does gender influence the acquisition of pedagogical skills by pre-service Biology teachers during teaching practice?
5. Does gender influence the usability of mobile technology by pre-service Biology teachers during teaching practice?

### **Research Hypotheses**

The following null hypotheses were tested in this study:

H<sub>01</sub>: There is no significant difference in the acquisition of pedagogical skills by pre-service Biology teachers during teaching practice based on gender.

H<sub>02</sub>: There is no significant difference in the usability of mobile technology by pre-service Biology teachers during teaching practice based on gender.

## **METHOD**

This study employed descriptive research of the survey type. It aimed to investigate the pedagogical skills of pre-service Biology teachers and the usability of mobile technology for instructional delivery during teaching practice in Ilorin, Kwara State, Nigeria. The population for this study comprised all Biology combination students in both public and private colleges of education in Ilorin. The target population encompassed all students offering Biology, regardless of their course parity, who were engaged in the teaching practice program. Samples were randomly drawn from three out of the six colleges of education, representing three different local government areas in Ilorin, to consist of 285 respondents from an estimated total of 703 Biology combination pre-service teachers.

A researcher-designed questionnaire was utilized to elicit information from the respondents. Random sampling was chosen for this study due to its versatility and the generalizability of results. Google Forms questionnaires were administered to the selected students, and their responses were promptly retrieved for data analysis.

## **RESULT AND DISCUSSION**

### **Data Analysis**

The data obtained were analyzed and interpreted using descriptive statistics and inferential statistics. Percentages were used to

analyze the personal information provided by the respondents. The mean was employed to address research questions one, two, and three, while a t-test was utilized to test the null hypotheses formulated from research questions four and five at the 0.05 level of significance. Results

### Analysis of Data to Answer the Research Questions

**Research Question One:** What pedagogical skills are used by pre-service Biology teachers in Ilorin during the teaching practice program?

Table 2: Mean and standard deviation of responses on the pedagogical skills used by pre-service teachers during teaching practice

S/N	ItemStatements	X	SD	Remark
1.	It is important for teachers to speak slowly and clearly enough that students can hear them.	3.46	0.85	Agreed
2.	It is necessary to emphasize keywords and alternate tones to engage listeners.	2.93	0.93	Agreed
3.	Changing the classroom layout maybe necessary to improve learning.	3.08	0.97	Agreed
4.	Reshuffling students sitting arrangement to ensure low scorers aren't sitting together is a good initiative	2.52	1.05	Agreed
5.	Encouraging students may improve their performance	2.89	0.99	Agreed
6.	Rewards and punishment may encourage better performance	2.42	1.10	Disagreed
7.	Providing support while students are learning a new concept is not important.	3.20	0.95	Agreed
8.	Using different formative assessment strategies can enhance learning	3.27	0.91	Agreed
9.	Paced repetition of keywords may not necessarily make learning easier for students	2.28	0.94	Disagreed
10.	Teachers should constantly scan through the whole class with their eyes to identify student who need help.	2.95	1.04	Agreed
	<b>Weightedaverage</b>	<b>2.90</b>	<b>0.97</b>	<b>Agreed</b>

Table 2 revealed that the respondents agreed that speaking clearly is an important pedagogical skill for pre-service teachers during teaching practice (mean=3.46). They also agreed on alternating tones to engage learners (mean=2.93). In addition, the respondents agreed that changing the classroom layout may improve learning (mean=3.08), as well as reshuffling students' seating arrangements (mean=2.52). The respondents agreed that encouraging students may improve their performance (mean=2.89), providing support while students are learning a new concept (mean=3.20), and using different formative assessment strategies to enhance learning (mean=3.27). Respondents agreed that they scan through the class with their eyes to identify who needs help among the students (mean=2.95). However, the respondents

disagreed with using rewards and punishment to encourage better performance (mean=2.42). Similarly, they disagreed with not using paced repetition (mean=2.28). All the 10 items have a standard deviation ranging from 0.85 to 1.17, which are below the fixed value of 1.96. This means that the responses of the respondents are not widespread as it is close to the mean. Overall, all the constructs in Table 1 represent the pedagogical skills used by pre-service Biology teachers in Ilorin during the teaching practice program. This was supported by an average mean and standard deviation of 2.91 and 1.00 (mean=2.90, SD=0.97).

**Research Question Two:** What is the level of awareness of mobile technology for instructional delivery by pre-service Biology teachers in Ilorin, Kwara State, Nigeria?

Table 3: Mean and standard deviation of responses on the level of awareness of mobile technology for instructional delivery by pre-service Biology teachers

S/ N	ItemStatements	X	SD	Remark
1.	Smart Phone	3.52	0.80	Aware
2.	Smart Watch	3.11	0.87	Aware
3.	Tablet	3.05	0.99	Aware
4.	PCs	3.29	0.96	Aware
5.	Laptops	3.32	0.91	Aware
6.	PDA's	3.31	0.91	Aware
7.	Game Consoles	3.03	0.98	Aware
8.	E-Readers	3.15	0.97	Aware
<b>Weightedaverage</b>		<b>3.63</b>	<b>0.92</b>	<b>Aware</b>

Table 2 revealed that the respondents indicated their awareness of smartphones (mean=3.52), smartwatches (mean=3.11), tablets (mean=3.05), PCs (mean=3.92), laptops (mean=3.32), PDA's (mean=3.31), game consoles (mean=3.03), and e-readers

(mean=3.15) as mobile technologies that can be used for instructional delivery.

**Question Three:** What is the level of usability of mobile technology for instructional delivery as perceived by pre-service Biology teachers in Ilorin, Kwara State, Nigeria?

Table 3: Mean and standard deviation of responses on the level of usability of mobile technology for instructional delivery by pre-service Biology teachers

S/ N	ItemStatements	X	SD	Remark
1.	Smart Phone	3.05	0.99	Usable
2.	Smart Watch	2.28	0.94	Not Usable
3.	Tablet	3.52	0.80	Usable
4.	PCs	3.29	0.96	Usable
5.	Laptops	3.32	0.91	Usable
6.	PDA's	3.31	0.91	Usable
7.	Game Consoles	3.03	0.98	Usable
8.	E-Readers	3.15	0.97	Usable
<b>Weightedaverage</b>		<b>3.11</b>	<b>0.93</b>	<b>Usable</b>

Table 3 revealed that the respondents indicated that smartphones (mean=3.05), tablets (mean=3.05), PCs (mean=3.92), laptops (mean=3.32), PDA's (mean=3.31), game consoles (mean=3.03), and e-readers (mean=3.15) are mobile technologies that can be used for instructional delivery. However,

the respondents indicated that smartwatches (mean=2.28) are not usable for instructional delivery when teaching biology.

**Research Question Four:** Does gender influence the acquisition of pedagogical skills by pre-service Biology teachers during teaching practice?

Table 4: Mean and standard deviation of responses on the pedagogical skills acquired by pre-service Biology teachers based on gender

Gender	N	M	SD
Male	119	75.46	15.50
Female	166	76.11	16.35

Table 4 revealed that the mean scores of the pedagogical skills by pre-service Biology teachers based on gender were presented, with female teachers having marginally higher means (M=76.11, SD=16.35) compared to male teachers (M=75.46, SD=15.50).

**Hypothesis One:** There is no significant difference in the acquisition of pedagogical skills by pre-service Biology teachers during teaching practice based on gender.

Table 5: t-test analysis of acquisition of pedagogical skills by pre-service Biology teachers during teaching practice based on gender

Gender	N	M	SD	T	Df	Sig
Male	119	75.46	15.50			
				.34	283	.74
Female	166	76.11	16.35			

$p > 0.05$

The t-test statistical result ( $t(283)=0.34$ ,  $p=0.74$ ) showed that there was no significant difference in the acquisition of pedagogical skills by pre-service Biology teachers during teaching practice based on gender, as indicated in Table 5. Hence, Hypothesis 1 was not rejected, as the p-value of 0.74 was greater

than the 0.05 alpha level. This implies that the acquisition of pedagogical skills by pre-service Biology teachers during teaching practice did not differ based on gender.

**Research Question Five:** Does gender influence the usability of mobile technology by pre-service Biology teachers during teaching practice?

Table 6: Mean and standard deviation of responses on the usability of mobile technology by pre-service Biology teachers based on gender

Gender	N	M	SD
Male	119	74.96	15.01
Female	166	76.51	16.20

Table 6 revealed that the mean scores of the usability of mobile technology by pre-service Biology teachers based on gender were presented, with female teachers having marginally higher means (M=76.51, SD=16.20) compared to male teachers (M=74.96, SD=15.01).

**Hypothesis Two:** There is no significant difference in the usability of mobile technology by pre-service Biology teachers during teaching practice based on gender.

Table 7: t-test analysis of the usability of mobile technology by pre-service Biology teachers during teaching practice based on gender

Gender	N	M	SD	T	Df	Sig
Male	119	74.96	15.01			
				.32	283	.71
Female	166	76.51	16.20			

$p > 0.05$

According to the t-test statistical result presented in Table 7 ( $t(283)=0.32$ ,  $p=0.71$ ), there was no significant gender difference in the usability of mobile technology during teaching practice for pre-service Biology instructors. Consequently, since the p-value for Hypothesis 1 was greater than the 0.05 alpha threshold, it was not rejected. This suggests that there was no

gender difference in pre-service biology instructors' capacity to use mobile technologies during their classroom practice.

## CONCLUSION

Pre-service teachers are aware of the importance of learning and applying pedagogical skills to succeed in their teaching

careers after graduation. The use of mobile technologies can help improve teaching effectiveness. It provides future teachers with the opportunity to engage students using images, films, and documents that can make learning enjoyable and dispel erroneous or incorrect ideas when teaching biology. The following specific conclusions were drawn based on this and the key findings presented above:

Respondents demonstrated a wide awareness of mobile technologies.

The significant majority of respondents confirmed the applicability of mobile technologies by using one or more of them for instructional delivery. Smartphones, tablets, and laptops were the most commonly utilized mobile devices for teaching, while e-readers, game consoles, and PDAs were the least popular. As previously mentioned, the majority of respondents have not used a smartwatch to offer instruction.

All pre-service teachers have cellphones; therefore, it might be claimed that their accessibility is one factor in the popularity of smartphones.

There were no gender-based differences in the respondents' knowledge of pedagogy or their comfort with using mobile technologies.

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