PRE-SERVICE SCIENCE EDUCATORS' PERCEPTION OF PEDAGOGICAL SKILLS ACQUISITION AND THE USE OF OPEN TECHNOLOGY FOR INCLUSIVE CLASSROOM INTERACTION

ABDULAZEEZ, Bolanle Tawakalt-Anu, **BOLAJI,** Hameed Olalekan, **IBRAHIM,** Abdulmuhsin
Department of science education, Faculty of Education, Al-Hikmah University, Ilorin, Nigeria.
bolanleabdulazeez@gmail.com

Abstract
Inclusive education, as emphasized in SDG4, seeks to ensure that students with special educational needs (SEN) learn alongside their non-disabled peers in the same classroom environment, receiving equal learning opportunities. Despite its importance, the effective implementation of inclusive education remains a challenge, largely due to gaps in educator training programs. This study explores ways to address these challenges by examining how pre-service science educators can develop the necessary pedagogical skills through the use of open technology to facilitate inclusive classroom interactions. The study adopted a descriptive survey research design, formulating five research questions and testing two hypotheses at a 0.05 significance level. The target population included science education students from both public and private tertiary institutions in Ilorin. A total of 300 respondents were selected through random sampling, with 50 participants each drawn from a federal university, a state university, a private university, a federal college of education, a state college of education, and a private college of education. Data collection was conducted using a well-structured, 32-item questionnaire designed on a four-point Likert scale, titled "Pre-service Educators' Acquisition of Pedagogical Skills with Open Technology for Inclusive Classroom Questionnaire (PEAPSOTICQ)." Findings indicated that a significant obstacle to inclusive education in Nigeria is educators' limited knowledge, which stems from inadequate training. However, the integration of open technology can support pre-service educators in acquiring essential pedagogical skills. The study recommends enhancing teacher training programs and promoting awareness of open technology to improve the implementation of inclusive education.

Keywords: *Pre-Service Educators, Pedagogical Skills, Open Technology, Inclusive classroom*

Introduction

Science plays an important role in a developing nation; it brings about civilization and technological advancement. Its importance cannot be overemphasized because it effects are felt in all ramifications. The word "science" is derived from Latin word "scientia" which means knowledge so, science as a discipline is termed to be a creative structure, built on facts. According to Abimbola (2013) science is defined as a body of knowledge, a way or method of investigating, and a way of thinking in order to understand nature. In the submissions of Olorundare (2023), science is a self-criticizing, self-correcting and an improving activity which deals with facts relating to the natural phenomenon of the universe and how these are interpreted. The Business dictionary (2023) defined science as a body of knowledge comprising of measurable or veritable facts acquired through application of the scientific method and generalized into scientific laws or principles. The attitudes or values that underlie 'sciencing' is known as the spirit of science which

includes longing to know, questioning of all things, searching for data and their meaning, demand for verification, respect for logic, consideration of premises and consideration of consequences (Olorundare, 2023). Educators who teach science are not scientists but science Educators who have undergone Educators' training in science education.

Science education is a field concerned with sharing science content and processes with individuals that are not traditionally considered part of the scientific community. These individuals may be children, college students or adults within the public. In the submissions of Abimbola (2013), the field of science education comprises science content, a bit of sociology and some teaching pedagogy. The goal of science teaching is to produce scientifically literate citizenry (Olorundare, 2023). Science is being taught at the senior secondary level of education by educators who received a form of training known as Educator-education. Educators play a very crucial role in the education of children, they are mediators between the curriculum and the learners (Ernest, Christopher and kofi 2019). An educator is a person whose job is to teach in a school or college. The most basic definition of the Educator is that he/she is the person who does the teaching (Zincirili, 2021). An educator in the opinion of Adedeji and Bello (2016) is a unique human being who has learnt to use himself effectively and efficiently to help a society achieve their own purpose of education. The teaching profession has the most effective role in the process of teaching the cognitive and psychomotor details of other professions.

Ernest, Christopher and kofi (2019), the roles of educators cannot be displaced by any form of technology, they are the real mediators between curriculums and the learners. Educators have an important role in classroom behavior management, they spend one-third of their day at work in schools and in pursuit of the achievement of teaching aims which make an important contribution to students' academic success (Gelisi 2007). Thus, the poor quality of education and low achievement scores of students in school and external examination was attributed to the fast-disappearing breed of educators with "missionary" spirit (Mavic, 2020). The researcher found out that educators whose professionalism has come to be seen as an integral part of their character; and who are deeply committed to making a difference in the lives of their people are very few. Zincirili (2021) categorized learners who are taught to become educators later soon may be referred to as pre-service educators which means educators in training.

Pre-services educators experience different difficulties during the teaching practice program, some of which are mostly associated with instructional delivery, acquisition and use of pedagogical skills and technologies. Nigeria as a nation is striving hard to change its classroom educator's attitude toward accommodation of students with special need in accordance with SDG4 for vision 2030 (UNESCO, 2023). In the submissions of Spalding, Klecka, Lin, Odell and Wang (2010) educators are expected to meet the needs of all students and move them towards attainment of their individual potential evenly and are sometimes pressured to prepare students for maximum performance on high-stakes assessment tests. In research conducted by Attah (2023), the researcher submitted that meeting the needs of all students has become difficult for educators because of the deficiency in their training program. The researcher submitted that special education is placed as a different body of knowledge or discipline known as special education which has formed the basis of excluding elements of inclusive education from the Educator training programs in Nigeria.

Inclusive classroom was defined by McManis (2023) as a class setting where all students, regardless of any challenges they may have, are placed in the same learning condition in an age-appropriate general education class that are in their own neighborhood schools to receive high-quality instruction, interventions, and supports that enable them to meet success in the core curriculum. The idea of inclusiveness in education in Nigeria was to allow special education needs (SENs) students spend most if not all their time with their non-disabled colleagues in same class situations (Attah, 2023). Reaserchers (McManis, 2023; Attah, 2023; & Spalding, Klecka, Lin, Odell and Wang, 2010) opined that the success of inclusive education will depend primarily on accepting, understanding, and attending to student differences and diversity, which may include the physical, cognitive, academic, social, and emotional aspects when planning instructions.

Instruction that is well-planned moves students from their current level of competency toward explicit criteria for success (Marzano, Pickering, & Pollock, 2001). The essence of the use of different instructional delivery models is to enable the instructor or educator to surmount the challenges on the organization and passage of the instruction to students who are assumed to have come from different backgrounds, therefore, possess different learning styles, pace and understanding the lessons based on their previous knowledge (Lukman, 2023). The future of a country is in the hands of its educators and their use of pedagogical skills to ensure effectiveness of teaching and learning in the classroom. Pre-service educators need a high level of pedagogical skills to become effective educators in the future (Zincirili 2021).

Pedagogical skills were defined by The Indeed Editorial Team (2022) as educators' ability to instruct students and manage their classroom, learn the materials, understand their students, communicate with parents, collaborate with colleagues and form their own fair and consistent guidelines. In the opinion of Dew (2023) Pedagogical skills are linked to both helping students learn better, and ensuring students are well behaved. In the submissions Bolaji (2023), asking questions to find out the prior knowledge of students, rewarding their efforts, setting high expectations and spaced repetition are examples of pedagogical skills. According to Dew (2023) pedagogy is the art of teaching, it describes all the teaching strategies used by Educators. The researcher submitted that students need to be well behaved to learn more effectively. The Pedagogical skills, thus, include the capacity to plan, initiate, lead and develop education and teaching with the departure point in both general and subject-specific knowledge which can be acquired through open technology.

Open technology according to Buss (2015) may be defined as all forms of technologies that allows users access to platforms or systems with very few constraints or restrictions on use, reuse, retaining, revising, remixing and redistribution of materials. Open technology is essential for the acquisition of pedagogical skills because of the way it connects teaching to research in the subject of interest (Bolaji, 2023). In the discussions of Umar (2022), connecting teaching to research rest solely on the use of latest technologies. Open Technology thrives and feeds on Open Standards and Open Source and is better characterized as a process and attitude similar to the scientific process than by technological aspects (Scheerder & Koymans, 2023). In the submissions of Scheerder and Koymans (2023), an open technology project can be identified by how those tools and platforms are used: open participation, an ethic of sharing, and a willingness to adapt to the evolving needs of its participants. The challenges of inclusive classroom interactions in Nigeria as advanced by researchers (McManis, 2023; Savage & Erten 2015; & Attah, 2023) can be attributed to poor training of Educators from teaching schools. The researchers submitted that elements of

inclusive education are lacking in the educator training programs. Therefore, this study wants to investigate pre-service Biology educators' acquisition of classroom pedagogical skills with the use of open technology for inclusive education.

Purpose of the Study

The main purpose of this study was to find pre-service Science Educators' pedagogical skills with the use of open technology for inclusive classroom interaction.

Specifically, the study would seek to find out:

1. examine the level of awareness of pre-service science educators on open technologies.
2. find out the usability of open technologies for inclusive classroom interactions.
3. determine the pedagogical skills used by pre-service science educators for inclusive classroom interactions.
4. investigate the influence of gender on preservice educators' pedagogical skills in an inclusive classroom environment.
5. examine the influence of gender on pre-service science educators' use of open technologies for inclusive classroom interaction.

Research Questions

The following questions were raised and answered.

1. What is the level of awareness of pre-service science educators on open technologies in Ilorin, Kwara state?
2. What is the level of usability of open technology for inclusive classroom by pre-service science educators in Ilorin, Kwara state?
3. What are the pedagogical skills used by pre-service science educators in an inclusive classroom environment?
4. Does gender influence the pedagogical skills employed for inclusive classroom interaction among pre-service science educators in Ilorin, Kwara state?
5. Does gender influence pre-service science educators on their use of open technology for inclusive classroom interaction in Ilorin, Kwara state?

Research Hypotheses

$H0_1$: Gender does not significantly influence the pedagogical skills for inclusive classroom interaction by pre-service science Educators in Ilorin, Kwara state.

$H0_2$: There is no significant difference in the level of usability of open technology for inclusive classroom by male and female pre-service Biology educators in Ilorin, Kwara state.

Methodology

The study adopted descriptive research method of the survey type. It investigated pre-service science educators' acquisition of pedagogical skills with the use of open technology for inclusive classroom interaction in Ilorin, Kwara state, Nigeria. The population for the study was all science education students in both public and private institution of higher learning in Ilorin. Samples were drawn randomly after the institutions had been stratified, fifty respondents each from one federal university, one state university, one private university, one federal college of education, one state college of education, and one private college of education. This gives a total of 300 respondents.

A researcher designed questionnaire was used to elicit information from the respondents. Random sampling was chosen for this study because of its versatility and generalizability of results. The 32 items questionnaire of 4 points Likert scale was titled "Pre-service Educators' Acquisition of Pedagogical Skills with the use of Open Technology for Inclusive Classroom Interaction Questionnaire (PEAPSOTICIQ)" and it has four sections, section A, B, C and D. Section A deals with pre-service Educators' biography; it contains information on the respondents' school type, gender, current level and course of study. Section B contains a list of open technologies to check the level of awareness of pre-service Educators. Section C contains a list of open technologies to check the level of usability by pre-service Educators. Section D deals with items on pedagogical skills Pedagogical Skills with the use of open technology for inclusive classroom interaction.

To ensure face and content validity of the instruments, Pre-service Educators' Acquisition of Pedagogical Skills with the use of Open Technology for Inclusive Classroom Interaction Questionnaire (PEAPSOTICIQ) was given to researcher's supervisor, two experts in Educational Technology Department and two experts in Information and Communication Technology to check whether the instrument will measure what it supposed to measure. The reliability of the instrument was determined outside the locale of the study using Cronbach Alfa Coefficient. The overall reliability score of the instrument was 0.76 which judged the instrument reliable. Institutions and students participating in this research work were not exposed to any risk as it was made known to them that their responses will be treated confidentially, and their identities will not be revealed to anyone. Benefits from the study were stated on the informed consent form and plagiarism test was carried out to determine if this work is not an existing work written by another researcher.

The researcher collected a letter of introduction from the Head of Department of Science Education, Al-Hikmah University, Ilorin. The researcher personally visited the institution of learning where the study was carried out and sought permission from authorities on the need to engage their students for the research study. Copies of an informed consent form were attached to the google forms for students to indicate their willingness for voluntary participation in the study. The researcher made it clear to the participating colleges and students that their effort and contributions will be treated confidentially and for the purpose of this study only. The researcher would seek the respondents' sincerity in their responses. The questionnaires were administered to the selected students through google forms and responses were automatically retrieved immediately for data analysis. The data obtained was analyzed and interpreted using descriptive statistics and inferential statistics. Percentages were used to analyze the personal information provided by the respondents. Mean scores were used to answer the research questions, t-test was used to test the hypotheses.

Results

Demographic data of Respondents

Table 1: Demographic Characteristics of Pre-service Science Educators

Variables	Options	Number of respondents	Percentage %
Gender	Male	124	41.33
	Female	176	58.67
Academic level	Year 2	260	86.67
	Year 3	40	13.33
School Type	Public	200	66.67
	Private	100	33.33
Course	Agric. Edu.	56	18.67
	Biology Edu.	72	24.00
	Chemistry Edu.	51	17.00
	PHE	50	16.67
	Physics Edu.	28	9.33
	Maths Edu.	43	14.33

Table 1 showed that the sample included 300 respondents, 260 respondents (86.67%) were year 2 students while 40 (13.33%) respondents were year 3 students, 124 males (41.33%) and 176 females (58.67%), 200 respondents (66.67%) attends public schools while 100 responddents (33.33%) attend private schools. 56 respondents (18.67%) are studying Agricultural science education, 72 respondents (24.00%) studying Biology education, 51 respondents (17.00%) studying chemistry education, 50 respondents (16.67%) studying PHE, 28 respondents (9.33%) studying physics education, and 43 respondents (14.33%) are studying mathematics education

Research Question One: What is the level of awareness of pre-service science educators on open technologies in Ilorin, Kwara state?

Table 2: Mean and standard deviation of responses on the level of awareness of pre-service science educators on open technologies in Ilorin, Kwara state.

S/N	**Item Statements**	X	SD	**Remark**
1.	Mozilla Firefox	3.52	0.80	Aware
2.	WordPress	3.11	0.87	Aware
3.	LibreOffice	3.05	0.99	Aware
4.	GNU Compiler Collection	2.29	0.35	Unaware
5.	GIMP	2.32	0.51	Unaware
6.	VLC Player	3.31	0.91	Aware
7.	Shotcut	2.03	0.48	Unaware
8.	Brave	2.15	0.39	Unaware
9.	Linus	2.01	0.47	Unaware
101	Python	3.23	0.91	Aware
1.	PHP	2.12	0.42	Unaware
	Weighted average	**2.34**	**0.57**	**Unaware**

Table 2 revealed that the respondents indicated their awareness of Mozilla Firefox (mean=3.52), WordPress (mean=3.11), LibreOffice (mean=3.05), VLC Player (mean=3.31), and Python (mean=3.23) as open technologies that can be used for instructional delivery. They declared that they are unaware of GNU Compiler Collection, GIMP, Shotcut, Brave, Linus, and PHP with means between 2.03 and 2.32 which is lower than the 2.5 benchmark for awareness on the four-point scale.

Research Question Two: What is the level of usability of open technology for inclusive classroom by pre-service Science Educators in Ilorin, Kwara state?

Table 3: Mean and standard deviation of responses on the level of usability of open technology for inclusive classroom by pre-service Science Educators in Ilorin, Kwara state.

S/N	**Item Statements**	X	SD	**Remark**
1.	Mozilla Firefox	3.12	0.82	Usable
2.	WordPress	3.21	0.78	Usable
3.	LibreOffice	3.45	0.91	Not Usable
4.	GNU Compiler Collection	2.15	0.59	Not Usable
5.	GIMP	2.23	0.51	Not Usable
6.	VLC Player	3.07	0.91	Usable
7.	Shotcut	2.17	0.84	Not Usable
8.	Brave	2.05	0.58	Not Usable
9.	Linus	2.26	0.97	Not Usable
10.	Python	3.53	0.91	Usable
11.	PHP	2.09	0.42	Not Usable
	Weighted average	**2.67**	**0.75**	**Usable**

Table 3 revealed that the respondents indicated that Mozilla firefox (mean=3.12), Word Press (mean=3.21), Libre Office (mean=3.45), VLC Player (mean=3.07), and Python (mean=3.53) are usable open technologies that for instructional delivery in an inclusive classroom environment. They indicated that GNU Compiler Collection, GIMP, Shotcut, Brave, Linus, and PHP with means between 2.05 and 2.26 which is lower than the 2.5 benchmark for awareness on the four point scale are not usable for instructional delivery.

Research Question Three: What are the pedagogical skills used by pre-service science educators in an inclusive classroom environment?

Table 4: Mean and standard deviation of responses on the pedagogical skills used by pre-service Educators during teaching practice.

S/N	**Item Statements**	X	SD	**Remark**
1.	It is important for Educators 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.	Educators should constantly scan through the whole class with their eyes to identify student who need help.	2.95	1.04	Agreed
	Weighted average	**2.90**	**0.97**	**Agreed**

Table 4 revealed that the respondents agreed that speaking clearly is an important pedagogical skill for pre-service Educators 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 classroom layout may improve learning (mean = 3.08), so is reshuffling students sitting arrangements (mean = 2.52). The respondents agreed that encouraging students to improve their performance (mean = 2.89), agreed to providing support while students are learning a new concept (mean = 3.20), and use different formative assessment strategies to enhance learning (mean = 3.27). Respondents agreed that they scan through class with their eyes to identify who needs help among the students (mean = 2.95). Though the respondents disagreed with using rewards and punishment to encourage better performance (mean = 2.42). Same way they disagreed with not using paced repetition (mean = 2.28). All the 10 items has a standard deviation ranges 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 constructions in the Table 4 are the pedagogical skills used by pre-service Biology Educators in Ilorin during the teaching practice program. This was supported by an average mean and standard deviation of 2.91 and 0.97 (mean = 2.91, SD = 0.97).

Research Question four: Does gender influence the pedagogical skills employed for inclusive classroom interaction among pre-service science educators in Ilorin, Kwara state?

Table 5: Mean and standard deviation of responses on the pedagogical skills employed for inclusive classroom interaction among pre-service science educators in Ilorin, Kwara state.

Gender	N	M	SD
Male	124	73.46	15.31
Female	176	78.21	16.25

Table 5 revealed the mean scores of the pedagogical skills employed for inclusive classroom interaction among pre-service science educators in Ilorin, Kwara state based on gender, with female pre-service educators having marginal higher mean (*M*=78.21, *SD*=16.25) when compared with male pre-service educators (*M*=73.46, *SD*=15.31).

Hypothesis 1: Gender does not significantly influence the pedagogical skills for inclusive classroom interaction by pre-service science Educators in Ilorin, Kwara state.

Table 6: **t-test analysis of the pedagogical skills employed for inclusive classroom interaction among pre-service science educators in Ilorin, Kwara state.**

Gender	N	M	SD	T	df	Sig
Male	124	73.46	15.31			
				.34	300	.74
Female	176	78.21	16.25			

p>0.05

The t-test statistics result ($t_{(300)}$=0.34, p=0.74) showed that there was no significant difference in the pedagogical skills for inclusive classroom interaction by pre-service science Educators in Ilorin based on gender as shown in Table 5. Hence, hypothesis 1 was not rejected as the p-value 0.74 was greater than 0.05 alpha level. This implies that the pedagogical skills employed by pre-service science educators for inclusive classroom interaction during teaching practice did not differ based on gender.

Research Question five: Does gender influence pre-service science educators on their use of open technology for inclusive classroom interaction in Ilorin, Kwara state?

Table 7: Mean and standard deviation of responses on the influence of gender on pre-service science educators' use of open technology for inclusive classroom interaction in Ilorin, Kwara state?

Gender	N	M	SD
Male	124	73.91	15.01
Female	176	76.21	16.20

Table 7 revealed the mean scores of gender influence pre-service science educators on their use of open technology for inclusive classroom interaction in Ilorin, with female pre-service educators having marginal higher mean (*M*=76.21, *SD*=16.20) when compared with male pre-service educators (*M*=73.91, *SD*=15.01).

Hypothesis 2: There is no significant difference in the level of usability of open technology for inclusive classroom by male and female pre-service science educators in Ilorin, Kwara state.

Table 8: t-test analysis of the level of usability of open technology for inclusive classroom by male and female pre-service science educators in Ilorin, Kwara state.

Gender	N	M	SD	T	df	Sig
Male	124	73.91	15.01			
				.32	300	.71
Female	176	76.21	16.20			

p>0.05

The t-test statistics result ($t_{(300)}$=0.32, *p*=0.71) showed that there was no significant difference in the usability of open technology for inclusive classroom by male and female pre-service science educators during teaching practice based on gender. Hence, hypothesis 2 was not rejected as the p-value 0.71 was greater than 0.05 alpha level. This implies that the usability of open technology by pre-service science educators during teaching practice did not differ based on gender.

Discussions

The study's findings reveal that pre-service science educators in Ilorin demonstrate varying degrees of awareness and usability concerning open technologies for instructional delivery in inclusive classrooms. Analysis from Table 2 indicates that respondents were familiar with Mozilla Firefox, WordPress, LibreOffice, VLC Player, and Python, as their mean awareness scores exceeded the 2.5 benchmark. Conversely, technologies such as the GNU Compiler Collection, GIMP, Shotcut, Brave, Linus, and PHP were largely unfamiliar to them, suggesting that these tools are either not widely integrated into their training or are not emphasized in their teaching methodologies. This lack of awareness implies that pre-service educators may not possess the requisite knowledge to effectively incorporate all available open technologies into their classrooms, which could hinder their ability to foster inclusive and technologically enriched learning environments (Attah, 2023). Similarly, data from Table 3 highlights that while technologies like Mozilla Firefox, WordPress, VLC Player, and Python were considered usable for instructional delivery, the GNU Compiler Collection, GIMP, Shotcut, Brave, Linus, and PHP were rated as less usable. The overall weighted mean of 2.67 suggests a moderate level of usability of open technologies in inclusive classroom settings. This aligns with the perspective of Spalding et al. (2010), who assert that the adoption of technology in education is largely influenced by familiarity, accessibility, and perceived utility. The limited usability of certain technologies may be attributed to inadequate training, insufficient exposure, or a lack of necessary infrastructure to support their integration into teaching practices.

An assessment of the pedagogical skills employed by pre-service educators, as shown in Table 4, indicates that respondents acknowledged the significance of clear communication, varied vocal tones, flexible classroom layouts, strategic student seating arrangements, active learning support, and diverse formative assessment strategies.

The weighted mean of 2.90 suggests that these strategies are widely practiced. However, the respondents disagreed with the use of rewards and punishment as a motivational tool and did not perceive paced repetition of keywords as an effective learning technique. These findings align with McManis (2023), who emphasizes that effective instructional delivery in inclusive classrooms necessitates adaptable teaching strategies that accommodate diverse learning needs while avoiding rigid or punitive measures that could impede student engagement. The study also explored the role of gender in shaping pedagogical skills for inclusive classroom interactions. Table 5 indicates that female pre-service educators had slightly higher mean scores compared to their male counterparts. However, the t-test results presented in Table 6 revealed that this difference was not statistically significant, suggesting that gender does not determine the pedagogical skills employed in inclusive classrooms.

This supports the argument by Attah (2023) that pedagogical competence is not inherently gender-based but is instead shaped by training, experience, and exposure to best practices in inclusive education. A similar trend was observed regarding the influence of gender on the usability of open technologies in inclusive classrooms. Table 7 shows that female pre-service educators had marginally higher mean scores than their male counterparts, yet the t-test results in Table 8 confirmed that the difference was not statistically significant. This suggests that both male and female pre-service educators exhibit comparable levels of competence in integrating open technology into instructional practices. This finding is consistent with the argument by Olorundare (2023) that gender does not play a decisive role in technological adoption in education; rather, access to training and resources is a more critical determinant.

The study highlights the need for enhanced training programs that expose pre-service educators to a wider range of open technologies, thereby improving both awareness and usability. Since inclusive education aims to create equitable learning opportunities for all students, it is essential that educators are equipped with a diverse set of technological tools to address varied learning needs (UNESCO, 2023). The limited familiarity and usability of certain open technologies suggest gaps in pre-service training, which could be mitigated through targeted professional development initiatives. Additionally, the study underscores the significance of pedagogical skills in fostering effective learning experiences in inclusive classrooms. Key strategies such as clear communication, flexible classroom arrangements, and diverse formative assessments were identified as crucial elements of inclusive teaching.

However, the rejection of punitive motivational techniques indicates a preference among pre-service educators for supportive and student-centered instructional approaches. This aligns with contemporary educational perspectives that emphasize positive reinforcement and differentiated instruction as essential components of effective teaching (Ernest, Christopher, & Kofi, 2019).

Conclusions

The study highlights the need for enhanced training programs that expose pre-service educators to a wider range of open technologies, thereby improving both awareness and usability. Since inclusive education aims to create equitable learning opportunities for all students, it is essential that educators are equipped with a diverse set of technological tools to address varied learning needs (UNESCO, 2023). The limited familiarity and usability of certain open technologies suggest gaps in pre-service training, which could be mitigated through targeted professional development initiatives. Additionally, the study underscores the significance of pedagogical skills in fostering effective learning experiences in inclusive classrooms. Key strategies such as clear communication, flexible classroom arrangements, and diverse formative assessments were identified as crucial elements of inclusive teaching.

Recommendations

Based on the findings of the study, the following recommendations are made:

1. Awareness should be made in seminars, conferences and workshops for Open technologies to become popular and widely used among. Pre-service Science Educators should ensure the use of pedagogical skills
2. Pre-service Educators should keep themselves up to speed with the latest open technologies that could be used for instructional delivery.
3. Pre-service Educators should be taught to use pedagogical skills like communication, Adaptability, Collaboration, Inclusivity and Compassion during instructional delivery in the Educators' training program.
4. Male and female pre-service Educators should employ appropriate pedagogical skills for an inclusive classroom
5. Male and female pre-service Educators should be exposed to using open technology during their teacher training program, this will make the SDG4 achievable.

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