



In-Service Training Needs of Science Teachers in Using Digital Technology in Teaching Students

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Abstract

The study determined the in-service training needs of science teachers in using digital technology in teaching students. The study was directed by two research questions. The study employed a descriptive survey research design. All 204 science teachers in Anambra State's public secondary schools made up the study's population. A 24-item, four-point scale structured questionnaire that was created by the researchers and approved by three specialists served as the research tool. Cronbach Alpha was used to determine the instrument's reliability, and a result of 0.87 was found. A 95.59% return rate was achieved, with 195 of the 204 copies of the questionnaire that were sent out via the Google form link being returned and used for data analysis. The mean, standard deviation, and independent sample t-tests were used to analyse the gathered data. The findings of the study showed that in-service training is highly needed by science teachers in the use of social media and virtual classrooms in teaching students in the digital technology era. The findings led to several recommendations, one of which was that the government should fund teacher in-service training on the use of digital technology in secondary school scientific instruction.

Keywords: In-service training, science teachers, digital technology and science students

Introduction

In today's technologically advanced digital society, education has been recognised as a critical instrument for developing human capital. The importance of education and training has increased globally as both developed and developing countries rely on them to advance their technical and economic development. According to Onyebuenyi et al. (2017), education, whether formal or informal, is the means by which people can acquire the bare minimum of moral principles and standards that can help them grow, and the management of schools should behave sensibly.

Formal education is crucial to government administration and policymaking because it equips citizens with the information and abilities they require to be successful in the workforce. Learners are prepared to move through the many levels of formal education, which include postsecondary education, senior secondary education, and basic education (which

includes nursery, primary, and junior secondary). Due to its critical role in both individual and societal development, secondary education is a significant component of the educational system in Africa, including Nigeria. Children between the ages of 12 and 18 who obtain secondary education come after primary school but before tertiary education (FRN, 2014). For instance, secondary education, as pointed out by Ogbodo (2016), is a post-basic education level prepared to train students for the world of work and higher education. The secondary education students are provided with different subjects and/courses such as science education subjects like chemistry, physics, biology, mathematics, among others, which are designed to enable them to develop their potential.

Science subjects in formal education are designed to equip learners with scientific processes and methods in solving everyday problems. In secondary

schools, the teaching of science subjects is carried out by science teachers. Science teachers, according to Aniodoh (2015), are educators trained in the theoretical, practical and pedagogical knowledge of imparting and transferring scientific knowledge, skills and processes to the learners. Science instruction and learning always deal with local environmental and cultural issues while also exposing students to national challenges in other cultures, which results in the development of globally minded individuals (Oloyede & Johnson, 2020). Teaching is a conscious action intended to modify the behaviour of the students. The content of these instructions in the present school system demands that teachers utilise digital technologies due to the innovations in Information and Communication Technologies (ICT). As times change, it is critical that science teachers receive training so they can prepare their pupils to use digital technology to address today's societal concerns.

Digital technology includes electronics that produce, amass, or analyse information. Digital games, social media, virtual classrooms, mobile phones, and internet components are well-known examples. It is used to gather, store, evaluate, and disseminate tangible data while offering crucial technical assistance for innovation across a range of industries. In order to provide online teaching and learning activities and tasks, digital technology, e-content, and instructional methodologies are combined. Olaniyi (2022) defines digital teaching and learning as any kind of educational activity that incorporates digital technologies or pedagogical strategies that make good use of the technology. In today's tech-driven world, instructors of all academic levels are expected to use digital technology for teaching and learning. As a result, Pakombwele and Tsakeni (2024) emphasised the necessity for teachers to switch to new approaches to using digital technology in order to instruct young students utilising digital resources.

Additionally, in an online learning environment, digital technology supports various learners' educational experiences and accomplishments. Google, lectures in video form, blogs, social media, PowerPoint, and Prezi are examples of digital technology. Likewise, it contains educational resources that incorporate technology into various subject areas, with examples including mobile computing, online gaming, multimedia cloud computing, and 3D printing. However, the kind of digital technology utilised to teach science courses relies on the teacher's digital proficiency and availability. Among the digital

technologies are social media (SM), virtual classrooms, the internet, online classrooms, video conferencing, Prezi and PowerPoint presentations. This study was centred on social media and virtual classrooms because of their wide reach, accessibility, ability to ensure personalised learning and the growing demand for online learning.

The utilisation of social media has grown so vast that people use the platform for different interactions and communication purposes, including teaching and learning. SM is an application involved in activities including online networking and socialising via text, images, and video. Ugwu (2019) defines social media as a group of wireless and web-based technologies that are essential to the creation of engaging platforms that let individuals and groups share and update content generated by users. Accordingly, Okeke (2019) claimed that social media brought about significant and widespread transformations in communities and organisations. A prominent feature of social media is its capacity to evolve from a means of disseminating content to one that encourages dialogue, information sharing, and the evocation of unprecedented personal, professional, social, and even global transformations. Science teachers may equally adopt a virtual classroom in teaching and learning their subjects.

A virtual classroom is also another digital technology that is used by tutors to transfer knowledge to learners. As noted by Mbah and Ezeilo (2019), a virtual classroom is not all that different from a traditional classroom; students take part in the class or sit in front of their computers in their rooms while the teacher teaches remotely, in front of a computer's camera. Similar to a typical classroom, a virtual classroom allows for interaction between lecturers and students. A collaborative web conferencing application featuring an online whiteboard and breakout area is known as a virtual school.

In addition, in the digital age, using digital technology to teach and understand science subjects would benefit science instructors. However, this utilisation can only be achieved if science teachers receive in-service training that exposes them to new technologies. A working teacher can enhance their proficiency by participating in relevant classes and activities that make up in-service training, according to Osamwonye (2016). Consequently, it covers the training along with the instructions assigned to an educator who is actively involved in teaching and learning. In-service training teachers are already

practising teachers who are undergoing a re-training programme in the form of workshops and seminars in order to improve their service delivery in schools. Oluka et al (2021) opined that because of a lack of in-service training on the areas of need for teachers, especially digital technologies and other innovative pedagogy, the quality of service delivery by the teachers declined. This has affected the academic performance and interest of students in schools. Teachers should possess digital technology skills to effectively engage the students in schools and out of school.

Given that researchers like Livingstone et al. (2023) discovered a positive correlation between digital skills and online alternatives, information benefits, and technology orientation, as well as an indirect association linking higher digital skills and increased exposure to online risks, it is imperative that teachers identify their digital skills needs. According to research by Gómez-Poyato et al. (2022), students' training in digital skills needs to be included in university training programs at the same time that the pandemic became the catalyst for the widespread use of ICTs. The future of business education in Nigeria is largely dependent on digitalisation and how well business education students use it (Olaniyi, 2022). Graduates of business education programs can only fulfil their assigned roles in society once they have a solid foundation in the digital skills necessary to thrive in the twenty-first century. In a related development, Ubah (2023) identified that social media and virtual classrooms are utilised to a low extent in adult and continuing education for achieving sustainable development goals. Oluka et al. (2021) found that school teachers received little in-service training using video conferencing and PowerPoint. Most studies show inadequate teacher training in ICT and other digital abilities, according to Fernández-Batanero et al. (2020). In a different research, Vázquez et al. (2021) averred that university instructors' digital proficiency is primarily intermediate and varies by generational cohort but is not gender specific. Regardless of the variables examined, the various research findings indicate that teaching curricula must prioritise the advancement of digital proficiency for both instructors and learners. The reviewed empirical studies were carried out in business education, adult education, and digital skills needs, but there exists limited research on the best knowledge of the researchers on the in-service training needs of science teachers in the utilisation of digital technology. In order to bridge this gap, taking into cognisance the importance of science in national development, it is

necessary to determine the in-service training needs of science teachers in using digital technology in teaching students in Anambra State.

Siemens' (2004) connectivist philosophy served as the foundation for this investigation. This theory aims to explain how people who utilise online, collaborative, and personalised technologies learn in ways that were not available to people in earlier generations. Siemens' main contention is that earlier human-led educational tasks and processes may be delegated to technology, and that learning is now lifelong and primarily informal. Siemens also argues that behaviourism, cognitivism, and constructivism—the three main theories of learning—all place the locus of learning inside the learner. Siemens states that learning can now be dispersed throughout social networks, personal learning communities, and outside of the learner through the use of networked devices. This theory is pertinent to the research because innovations in teaching sciences in contemporary society are most recently driven by digital technology. For instance, social media and other ICTs and their application to teaching and learning activities have implications in day-to-day learning in and outside the school. The science teachers' in-service training needs in digital technologies and other innovations help in information circulation and obtaining up-to-date knowledge for functioning in a digital-driven society. The utilisation of digital devices in education and other areas has the capacity to boost the quality and sustainability of training provided to students.

Research Questions

The study was guided by the following research question:

1. What are the social media in-service training needs of science teachers in using digital technology in teaching students?
2. What are the virtual classroom in-service training needs of science teachers in using digital technology in teaching students?

Hypotheses

The following null hypotheses were tested at the 0.05 level of significance.

1. There is no significant difference between the mean response of male and female respondents on the social media in-service training needs of science teachers in using digital technology in teaching students.

2. There is no significant difference between the mean response of male and female respondents on the virtual classroom in-service training needs of science teachers in using digital technology in teaching students.

Methodology

A descriptive survey research design was used in the study. Nworgu (2018) defines descriptive survey research as a study that gathers and examines data from a small number of individuals or items that are thought to be typical of the full group. This study's design will be suitable since the opinions of the participants will be gathered and examined in order to ascertain the requirements for in-service training for science instructors in Anambra State on the usage of digital technology in the classroom. In the Awka South Local Government Area of Anambra State, 204 science instructors from 19 public secondary schools made up the study's population. The population as a whole was the sample size. A 24-item structured questionnaire served as the data-gathering tool. Following a thorough examination of the literature, the questionnaire was created. "A" and "B" were the two sections of the questionnaire. The respondents' personal information is covered in Section "A," whereas the topics of science teachers' in-service training requirements for digital technology use are covered in Section "B." The items had numerical values of 4, 3, 2, and 1, respectively, and were organised according to a modified four-point

Likert scale: Very Highly Needed, Highly Needed, Moderately Needed, and Not Needed. Three experts—two from Nnamdi Azikiwe University Awka's Department of Science Education and one from the Department of Educational Foundations' Measurement and Evaluation Unit—validated the questionnaire. They had to verify the instrument's accuracy in addressing the research questions by looking at its clarity, sentence structure, and item phrasing. The final study instrument was altered based on their feedback and recommendations. In order to determine the instrument's dependability, science instructors in Anambra State's Awka North LGA were given 20 copies of the questionnaire. A coefficient index of 0.87 was determined when the Cronbach Alpha reliability technique was used to examine the data from the administered questionnaire. The Google form link was sent to the respondents via their WhatsApp numbers obtained from the Post Primary School Service Commission, Awka, in order to gather data relevant to the study. A 95.59% return rate was achieved, nevertheless, as 195 of the 204 copies of the questionnaire that were sent were returned and used for data analysis. The mean, standard deviation, and independent sample t-tests were used to examine the gathered data. A weighted mean score of 2.50 or more indicates agreement or significant need, whereas a score of less than 2.50 indicates disagreement or lack of need. SPSS Version 25 was used for this analysis.

Results

Table 1: Mean scores and standard deviation of teachers on the social media in-service training needs of science teachers in using digital technology in teaching students

S/N	Statement	Mean	SD	Decision
1.	Allocate the required social media software while connecting to the learners in the digital classroom	3.84	0.42	Agreed
2.	Network connectivity in different social media platforms	3.55	0.67	Agreed
3.	Install basic configuration options for social media	3.22	0.81	Agreed
4.	Locate resources to explore different social media	3.19	0.91	Agreed
5.	Use common networking technologies	3.29	0.70	Agreed
6.	Perform basic operation tasks in social media instructional delivery	3.37	0.69	Agreed
7.	Use offline reference materials as additional resources to connect to a network	3.41	0.67	Agreed
8.	Use electronic mails with social media	3.16	0.73	Agreed
9.	Upload a text file and send it as an electronic email	3.16	0.81	Agreed
10.	Use of social media tools in the delivery of lessons in the class	2.97	0.81	Agreed

11.	Sourcing of lesson material through social media	3.04	0.69	Agreed
12.	Prepare the social media classroom for the discussion method/interactive instruction	2.99	0.95	Agreed
13.	Preparing a lesson with social media	2.79	0.94	Agreed
	Cluster Mean	3.23	0.75	Highly Needed

All items 1 through 13 had mean scores more than 2.50, as Table 1 demonstrates. It is evident from this that every respondent agreed that the items are the social media in-service training requirements for science teachers who want to use digital technology to instruct students. The respondents' agreement with the

cluster mean of 3.23 suggests that all of the items addressed the social media in-service training requirements for science teachers who use digital technology to instruct pupils. The low standard deviation of 0.75 indicated that there is little variation in the responses.

Table 2: t-test statistics of the difference between the mean response of male and female respondents on the social media in-service training needs of science teachers in using digital technology in teaching students

Gender	N	Mean	SD	t-value	df	P-value	Dec.
Male	83	3.24	0.36	.356	193	.722	NS
Female	112	3.22	0.38				

SD = standard deviation, Dec. = Decision, NS = Not Significant

The values that were obtained are shown in Table 2 as (t-value = 0.356; df = 193; p-value 0.722). The null hypothesis was thus not rejected, suggesting that the mean responses of male and female respondents on the social media in-service training requirements of science teachers in using digital technology to instruct

students do not differ significantly. This suggests that males and females have similar opinions on the need for science teachers to receive in-service training on social media in order to use digital technology to instruct students.

Table 3: Mean scores and standard deviation of teachers on the virtual classroom in-service training needs of science teachers in using digital technology in teaching students

S/N	Statement	Mean	SD	Decision
14	Use of virtual classroom in lesson planning	3.08	0.84	Agreed
15	Use of virtual classroom in the delivery of lessons in the class	3.07	0.94	Agreed
16	delivering instruction at a distant location with the learners	2.86	0.82	Agreed
17	Prepare a virtual classroom for the discussion method/interactive instruction	3.19	0.83	Agreed
18	Prepare a virtual classroom for technological/instructional materials	3.49	0.68	Agreed
19	Use of virtual classroom to facilitate individualised learning activities	3.41	0.73	Agreed
20	Managing virtual classroom communication to improve science process skills	3.22	0.83	Agreed
21	Use a virtual classroom in the evaluation of learning	3.28	0.91	Agreed
22	Use a virtual classroom in collaborative instruction among students in different locations	3.12	0.77	Agreed
23	Use a virtual classroom for replaying instructional delivery	3.36	0.76	Agreed

24	Prepare a virtual classroom and provide animation to students	3.37	0.66	Agreed
Cluster Mean		3.22	0.78	Highly Needed

According to Table 3, the mean scores for items 14 through 24 are all higher than 2.50. This suggests that all of the respondents agreed with the items regarding the in-service training requirements for science teachers who use digital technology to instruct students in virtual classrooms. The respondents' agreement that every item in the table represents the in-

service training requirements for science teachers employing digital technology to instruct pupils is further demonstrated by the cluster mean of 3.22. The respondents' opinions on the stated virtual classroom in-service training needs of science instructors in employing digital technology in the classroom were similar, as indicated by the standard deviation of 0.78.

Table 4: t-test statistics of the difference between the mean response of male and female respondents on the virtual classroom in-service training needs of science teachers in using digital technology in teaching students

Gender	N	Mean	SD	t-value	df	P-value	Dec.
Male	83	3.27	0.42	1.489	193	.138	NS
Female	112	3.18	0.46				

SD = standard deviation, Dec. = Decision, NS = Not Significant

The data obtained are shown in Table 4 (t-value = 1.489; df = 193; p-value 0.138). Consequently, the null hypothesis was not rejected, suggesting that there is no discernible difference between the mean responses of male and female respondents on the in-service training requirements for science teachers in virtual classrooms when it comes to employing digital technology to instruct students. This suggests that males and females have similar opinions on the in-service training that science teachers need to use in virtual classrooms to teach students using digital technologies.

Discussion

The findings revealed that social media in-service training is highly needed by science teachers in using digital technology in teaching students. Further analysis revealed that no significant difference exists between the mean response of male and female respondents on the social media in-service training needs of science teachers in using digital technology in teaching students. Among the social media in-service training needs of science teachers includes; allocating required social media software while connecting to the learners in digital classroom, network connectivity in different social media platforms, installing basic configuration options for social media, locating resources to explore different social media, using common networking technologies, performing basic operation task in social media instructional delivery, using offline reference materials as additional resources

to connect to a network, using electronic mails with social media, uploading a text file and send it as electronic mails, utilizing social media tools in delivery of lesson in the class and sourcing of lesson material through social media. The results were consistent with those of Okeke (2019), who found that despite teachers' critical need for social media tools in their instructional delivery, these tools are not receiving the attention they require for the development of sustainable education. Similarly, Vázquez et al (2021) found that university teachers, irrespective of their gender, showed an urgent need for different digital skills. According to Ugwu (2019), incorporating social media video instruction into one's repertoire helps one stay up to date with technology and experiment with different instructional delivery methods. Teachers could increase the reach of their information by receiving in-service training in social media. This demonstrated how important social media is for scientific instructors in the age of digital technology-driven education.

With reference to research question two and its corresponding hypothesis, both the male and female respondents agreed that virtual classroom in-service training is highly needed by science teachers in using digital technology in teaching students. Moreover, the following were the most important areas for which in-service training was needed: using virtual classrooms for lesson planning, delivering lessons in the classroom, teaching students remotely, preparing virtual classrooms for interactive instruction and discussion methods, preparing virtual classrooms for technological

and instructional materials, using virtual classrooms to support individualised learning activities, managing virtual classroom communication to enhance science process skills, using virtual classrooms for learning evaluation, and preparing virtual classrooms to provide animation to students, among other things. The provision of this in-service training would enable the teachers to address the technological development needs in the classroom. This supports the research findings of Ortiz-Jiménez et al. (2020) and Nwafor et al. (2022) that teachers require occupational training in the use of ICT resources, such as virtual classrooms, in teaching and learning. Accordingly, the current study asserted that scientific instructors must have adequate training on how to instruct their students using a virtual classroom.

Conclusions

The study identifies the in-service training needs of science teachers in the use of social media and virtual classrooms in teaching students in the digital technology era. The findings showed the need for in-service training for science teachers in the use of their digital technology for effective instructional delivery. These findings would enable the educational stakeholders, government and administrators in secondary schools to facilitate their training of science teachers on the identified training needs. This is to improve their utilisation of digital technology in teaching science subjects to achieve the Sustainable Development Goals.

Recommendations

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

1. Science teachers should be provided with in-service training on the use of social media tools in preparing and delivering their lessons based on the digital age demand.
2. To enhance scientific instruction in secondary schools, virtual classrooms must be made available and utilised.
3. Resources for science teachers' in-service training in using digital technology to teach should be made available by the government.

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