



Influence Of Technology Professional- Development on Teachers Self-Efficacy in The Use of ICT For Teaching Basic Science and Technology.

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Abstract

The aim of this study was to assess the impact of technology professional development on teachers' self-efficacy in using Information Communication Technologies (ICT) for teaching in Abuja Metropolis. This study (i) assessed the technology professional development teachers have access to; (ii) determined the level of teachers' technology professional development; and (iii) determined the level of teachers' self-efficacy in the use of ICT for teaching; Methods: This research adopted descriptive research of the survey type. Participate: 338 teachers were randomly selected. The research instrument used for data collection is a questionnaire. Research questions 1, 2 and 3 were answered using mean score and percentages while the formulated hypothesis was tested using the t-test at 5% margin of error and at 95% confidence level. The result: the technology professional development that teachers have access to in Abuja metropolis are conferences, seminars and workshops.

*level of teacher's technology professional development in Abuja metropolis is high.
the level of teacher's self-efficacy in the use of ICT for teaching in Abuja metropolis is average and teachers' gender does not influence the technology professional development. The study recommended that among others that funds, ICT facilities, and trained teachers should be provided for the effective use of technology professional development on teachers' self-efficacy in the use of ICT for teaching in Abuja Metropolis.*

Keywords: Technology, Professional- Development, Teachers, Self-Efficacy Use, ICT

Introduction

Conventional educational practices no longer provide students with all the skills needed to survive economically in today's workplace. The integration of ICT tools in education holds immense potential to transform the teaching and learning experience, offering dynamic and interactive platforms for students to engage with subject matter. However, teachers' self-efficacy in using these technologies plays a critical role in their successful implementation. Technology professional development programs are designed to equip educators with the necessary skills and confidence to leverage ICT tools effectively. This study aims to explore the relationship between such professional development opportunities and teachers' self-efficacy in incorporating ICT into teaching basic science and technology.

Harnessing the potential of ICT tools for teaching has the capacity to engage learners, foster critical thinking, and cultivate essential skills for the 21st century (Arhin et al., 2022). However, the effective integration of technology in the classroom is contingent upon the confidence and competence of educators. This foundational aspect of instructional innovation hinges on a psychological construct known as self-efficacy – a belief in one's ability to execute specific tasks and achieve desired outcomes.

Teachers' self-efficacy in the use of ICT for teaching has garnered substantial attention due to its pivotal role in determining the extent to which technology becomes an integral part of the educational process (Ojo et al., (2023); Kundu, Bej, and Dey (2020). A significant factor that shapes this self-efficacy is the quality and nature of the professional development that educators receive. Professional development, particularly tailored to technology integration, has emerged as a linchpin for fostering educators' confidence and expertise in employing ICT tools effectively. This study delves into the intricate interplay between technology professional development and teachers' self-efficacy in the context of teaching basic science and technology. Teachers' self-efficacy, rooted in Albert Bandura's social cognitive theory, represents their belief in their capability to successfully execute tasks and achieve desired outcomes. In the context of ICT integration, teachers' self-efficacy is a significant predictor of their willingness to adopt and effectively use technology in instruction (Fadipe et al., (2022)

While the benefits of integrating technology into education are widely recognized, its adoption requires a comprehensive understanding of the psychological dynamics at play. Teachers, as the conduits of knowledge and skill development, must not only possess technological proficiency but also harbor the belief that they can orchestrate successful learning experiences using these tools. This belief in their own capabilities, known as self-efficacy, profoundly influences teachers' willingness to experiment with new instructional methods and their tenacity in overcoming obstacles that may arise during technology-infused lessons (Şimşek & Sarsar, 2019).

Technology professional development programs, designed to equip educators with the skills and knowledge required for effective technology integration, hold the promise of augmenting teachers' self-efficacy. These programs not only provide technical training but also offer pedagogical insights, strategies for managing diverse learning styles, and techniques for tailoring technology to curriculum goals. By

bridging the gap between technological innovation and instructional application, well-structured professional development endeavors possess the potential to reshape teachers' perceptions of their own abilities.

In the realm of basic science and technology education, the stakes are particularly high. Equipping students with foundational knowledge in these domains lay the groundwork for their participation in an increasingly complex and technology-driven world Elstad & Christophersen, (2017). Therefore, the ability of teachers to confidently wield ICT tools to illuminate these subjects is paramount. As technology becomes more deeply woven into the fabric of education, understanding the nexus between professional development and teachers' self-efficacy becomes indispensable. Effective professional development focuses not only on the technical aspects of technology but also on pedagogical strategies and their alignment with curriculum goals (Peter & Fadipe, (2022).

This study explores and elucidate the multifaceted relationship between technology professional development and teachers' self-efficacy in the context of utilizing ICT for teaching basic science and technology. Through a synthesis of quantitative data, the research endeavors to contribute to the growing body of knowledge that informs educational practices in an age of technological acceleration. By unravelling the threads that weave together effective technology integration and teacher confidence, this study seeks to empower educators and enrich the educational experiences of students venturing into the world of basic science and technology.

While ICT tools are widely used at all levels of education in developed countries, some schools are still not making the most of ICT in developing countries. The use of information and communication technology (ICT) in the education sector in most developing countries is still lagging. In Nigeria, many secondary school teachers are still incompetent. Teachers in Nigeria still exhibit considerable technology phobia, especially when compared to children who are "digital natives." Teachers are fearful of making mistakes or acknowledging a lack of knowledge or professional abilities. It limits the integration of technology to the establishment of an enabling learning environment, which causes pupils to lose interest and, as a result, motivation to study. This disconnects between students' expectations and teachers' competence leads to low academic performance, as well as dissatisfaction with their profession and personal consistency among teachers, hence this study

Purpose of Study

The main purpose of this study was to investigate teachers' self-efficacy in utilizing ICT tools for teaching Basic Science and Technology in Abuja . Specifically, the study:

1. investigated various ICTs available for teaching Basic Science and Technology subjects;
2. assessed basic science and technology teachers' self-efficacy in teaching basic science and technology subjects;
3. examined teachers' self-efficacy in utilizing ICTs for teaching Basic Science and Technology;

The following hypotheses were formulated and tested in this study at a 0.05 level of significance.

Ho₁: There is no significant difference between male and female Basic Science and Technology teachers’ self-efficacy in the use of ICTs in teaching.

Ho₂: There is no significant difference in the Basic Science and Technology teachers’ self-efficacy in the use of ICTs in teaching based on years of teaching experience

Methodology: A quantitative method of survey type was employed to measure teachers’ self-efficacy in utilizing ICT tools for teaching Basic Science and Technology in Abuja, this survey method enabling the researcher to generate relevant information from the respondents. The questionnaire was used to obtain relevant information from the sample. This study focused on determining teachers’ self-efficacy in utilizing ICTs for teaching basic science and technology in Abuja. Teachers of basic science and technology from various schools in Abuja comprising of both males and females were sampled for this study. Three hundred and thirty-eight basic science and technology teachers were randomly selected from schools in Abuja. A researcher-designed questionnaire was used as an instrument to collect data from the participant for the study and data collected was analysed using both descriptive and inferential statistics

The researcher with the help of a research assistant visited the sampled schools for the study to administer the questionnaire to the teachers having sought permission from the various authorities involved. Once the questionnaires have been distributed and they have been filled, they were retrieved immediately for further analysis. The information gathered was used for the purpose of this research only.

Data Analysis: The data collected from the respondents were analysed using descriptive and inferential statistics. Frequency counts and the percentage was used to present the demographic information of the respondents and to provide answers to the research questions. Hypothesis 1 was tested using a t-test while hypothesis 2 was tested using Analysis of Variance (ANOVA) at a 0.05 level of significance.

Results And Discussion: A total of three hundred and thirty-eight (338) copies of questionnaires were administered to Basic Science and Technology teachers in Abuja but only 331 questionnaire forms were accounted for and used for this study, hence, the results are presented in a descriptive format using frequency and percentage for the demographic information and the research questions. Inferential statistics of t-test and Analysis of Variance were used to analyse the three formulated null hypotheses at 0.05 level of significance.

Data Analysis

Table 1: Percentage Distribution of Respondents Based on Gender, Years of Teaching Experience and Teaching Subject

Variable	Frequency	Percentage
Gender		
Male	181	54.7
Female	150	45.3
Total	331	100
Years of Teaching Experience		
1-10 years	190	57.4
11-20 years	115	34.7

30 years and above	26	7.9
Total	331	100
Teaching Subject		
Basic Science	81	24.5
Basic Technology	56	16.9
Computer Science	143	43.2
PHE	51	15.4
Total	331	100

Table 1 showed the demographic data of the respondents. It was revealed that 181 (54.7%) of the respondents were male, while 150 (45.3%) of the respondents were female. Based on teaching experience, the table reveals that 190 (57.4%) of the respondents have teaching experience between 1-10 years, 115 (34.7%) of the respondents have between 11-20 years teaching experience, while 26 (7.9%) of the respondents have 20 years and above. The table also shows that 81 (24.5%) of the respondents were basic science teachers, 56 (16.9%) of the respondents were basic technology teachers, 143 (43.2%) of the respondents were computer science teachers while 51 (15.4%) of the respondents were physical and health education (PHE) teachers.

Research Question One: What are the ICT tools available for teaching Basic Science and Technology in Abuja?

To identify the ICT tools that are available to teach basic science and technology subjects in Abuja, questionnaire forms were used in collecting the data related to this purpose. Frequency and percentage were employed in analyzing the data collected. This is shown in Table 2 and subsequently interpreted.

Table 2: Percentage Distribution of list ICT Tools Available for Teaching Basic Science and Technology

S/N	Items	Available	Not Available
1	Desktop Computer	283 (85.5%)	48 (14.5%)
2	Printer	305 (92.1%)	26 (7.9%)
3	Scanner	219 (66.2%)	112 (33.8%)
4	Internet	151 (45.6%)	180 (54.4%)
5	Radio	122 (36.9%)	209 (63.1%)
6	Digital Camera	133 (40.2%)	193 (59.8%)
7	Flash Drives	250 (75.5%)	81 (24.5%)
8	CDs/DVDs	229 (69.2%)	102 (30.8%)
9	Virtual Library	151 (45.6%)	180 (54.4%)
10	Photocopier	269 (81.3%)	62 (18.7%)
11	Educational Software	153 (46.2%)	173 (53.8%)
12	Presentation Tools (PowerPoint, Prezi)	175 (58.9%)	122 (41.1%)
13	Interactive white board	110 (33.2%)	221 (66.8%)
14	Laptops	229 (69.2%)	102 (30.8%)
15	Projector	142 (42.9%)	189 (57.1%)

Table 2 revealed the percentage of available ICT tools with printer (92.1%); desktop computer (85.5%); photocopier (81.3%); flash drives (75.5%); CDs/DVDs (69.2%); laptops (67.3%); and scanner (66.2%) while 50% and above of the non-availability of ICT tools for teaching are educational software (53.8%); virtual library (54.4%); internet (54.4%); projector (57.1%); radio (63.1%); digital camera (59.8%); and interactive whiteboard (66.8%). This indicates that ICT tools are available for teaching basic science and technology in secondary schools in Abuja .

Research Question Two: What is the level of teachers’ self-efficacy in teaching basic science and technology in Abuja?

Table 3: Teachers’ Self-efficacy Level

Self- efficacy	Frequency	Percentage
Low	0	0.0
Average	23	6.9
High	308	93.1
Total	331	100

Table 3 showed that none of the respondents have low level of self-efficacy, 23 (6.9%) of the respondents have average level of self-efficacy while 308 (93.1%) have a high level of self-efficacy. This indicates that majority of the participants have high self-efficacy.

Research Question Three: What are the Basic Science and Technology teachers’ self-efficacy in utilizing ICT tools for teaching

Table 4: Percentage Distribution of Basic Science and Technology Teachers’ Self-Efficacy in Utilizing ICT Tools for Teaching

S/N	Skills	High	Average	Low
1	I can boot a computer system	242 (73.1%)	85 (25.7%)	1 (1.2%)
2	I can explore directory/ files on a laptop	223 (67.4%)	96 (29.0%)	12 (3.6%)
3	I can use the keyboard	252 (76.1%)	75 (22.7%)	4 (1.2%)
4	I can find primary source of information online that I can use for my teaching	276 (83.4%)	53 (16.0%)	2 (0.6%)
5	I can copy files from one location another	233 (70.4%)	82 (24.8%)	16 (4.8%)
6	I can start an application and create document	203 (61.3%)	113 (34.1%)	15 (4.5%)
7	I can create name/rename directory/subdirectories folder	203 (61.3%)	103 (31.1%)	25 (7.6%)
8	I can identify and use icons, windows and menus	204 (61.6%)	95 (28.7%)	32 (9.7%)
9	I can print from various networked printers for use in basic science and technology instruction	224 (67.7%)	79 (23.9%)	28 (8.5%)
10	I can keep track of website I have visited	216 (65.3%)	83 (25.1%)	32 (9.7%)

	so that I can return to them later. (an example is using bookmarks)			
11	I can engage student in meaningful instruction using computer assisted instruction	201 (60.7%)	114 (34.4%)	16 (4.8%)
12	I can connect computer with multimedia projector for basic science and technology instruction	171 (51.7%)	130 (39.3%)	30 (9.1%)
13	I can run an application programme e.g., PowerPoint, Excel and MS word to prepare my lesson in basic science and technology	202 (61.0%)	102 (30.8%)	27 (8.2%)
14	I can download and view educational streaming video clips	217 (65.6%)	89 (26.9%)	25 (7.6%)
15	I can access information on CD/DVD to teach my students in basic science and technology	228 (68.9%)	94 (28.4%)	9 (2.7%)

Table 4, presented the percentage distribution of basic science and technology teachers’ self-efficacy in utilizing ICT tools for teaching. The finding revealed that (82.5%) of basic science and technology teachers can find primary source of information online which can be used for their teaching; they can use the keyboard (76.1%); they can boot a computer system (73.1%); they can copy files from one location to another (70.4%); they can access information on CD/DVD to teach my students in basic science and technology (68.9%); they can explore directory/files on a laptop (66.6%); they can print from various networked printers for use in basic science and technology instruction (67.4%); they can download and view educational streaming video clips (65.6%); and they can keep track of website I have visited so that I can return to them later (an example is using bookmarks) (65.3%). This indicates that most of these teachers have a high self-efficacy in utilizing ICT tools for their teaching.

Results of Hypotheses Testing

Research Hypothesis One: There is no significant difference between male and female Basic Science and Technology teachers’ self-efficacy in the use of ICT tools for teaching

Table 5: Influence of Gender on Basic Science and Technology Teachers’ Self- Efficacy in the Use of ICT Tool for Teaching

Gender	N	X	SD	df	t	Sig. (2-tailed)	Remark
Male	181	40.21	5.87				
				329	3.13	.00	Not accepted
Female	150	37.80	8.07				

* Significant, $p < 0.05$

From Table 5, it can be deduced that there is significant difference between male and female Basic Science and Technology teachers’ self-efficacy in the use of ICT tool for teaching. This is reflected in the findings of the hypothesis tested $df (329)$, $t = 3.13$, $p < 0.05$. Thus, the hypothesis which states that “there is no significant difference between male and female Basic Science and Technology teachers’ self-efficacy in the use of ICT tool for teaching” is rejected.

Research Hypothesis Two:

There is no significant difference between male and female basic science and technology teachers’ self-efficacy in the use of ICT tools in teaching based on years of experience

Table 6: Influence of Years of Experience on Basic Science and Technology Teachers’ Self-Efficacy in the Use of ICT Tool for Teaching

Source	SS	df	Mean Square	Cal. F-	Sig. (2-tailed)	Remark
Between Groups	1960.89	2	980.44	22.2	.000	Not accepted
Within Groups	14431.51	328	43.99			
Total	16392.40	330				

* Significant, $p < 0.05$

Table 6 revealed that there is a significant difference in the basic science and technology teachers’ self-efficacy in the use of ICT tools in teaching based on years of experience. This is reflected in the findings of the hypothesis tested $df (328)$, Cal. F ratio = 22.28, $p < 0.05$. Thus, the hypothesis which states that “there is no significant difference in the basic science and technology teachers’ self-efficacy in the use of ICT tools in teaching based on years of experience” is rejected. In order to ascertain where the significant difference lies, Scheffe Post-Hoc was carried out and the output is shown on Table 7.

Table 7: Scheffe post-hoc where the significant difference lies based on Years of Teaching Experience

Years	N	Sub set for Alpha = 0.05		
		1	2	
11-20 years	115	35.83		
1-10 years	190	40.67		
20 years and above	26		42.31	
Sig.		1.000	.513	

Table 7, showed that respondents with 11-20 years of teaching experience and 1-10 years had the mean scores of 35.83 and 40.67 (in subset 1) respectively, while respondents who had 20 years of teaching experience and above had the mean score of 42.31 (in subset 2). This implies that the mean score of respondents who had 20 years of teaching experience and above is greater than the mean scores of

other age group, thus, contributed more to the significant difference than any other group.

Summary of Findings

The followings are summary of the findings from the study:

1. most ICTs are available in schools while few are not available for teaching;
2. the basic science and technology teachers in Abuja have high self-efficacy in solving problems associated with their teaching;
3. the basic science and technology teachers have a high self-efficacy in utilizing ICTs for teaching;
4. There was a significant difference between male and female Basic Science and Technology teachers' self-efficacy in the use of ICT tool for teaching in Abuja with 40.21% and 37.80% in favored of male;

Discussions

The study investigated teachers' self-efficacy in utilizing ICT tools for teaching basic science and technology subjects in Abuja. Research question 1 checked various ICT tools that are available for teaching basic science and technology in Abuja such ICT tools includes; printer, desktop computer; photocopier; laptops; scanner; virtual library among others. The finding revealed that most of these ICTs that are available for teaching BST in Abuja while few of the ICTs are not available. This finding is in support of Raphael, C. and Mtebe, J. S. (2017). which indicated that most of the sampled schools had ICT resources in a diverse amount, where some schools are better equipped with ICT resources. The schools had computers, computer laboratories, projectors, Televisions, video players, storage hard discs, digital content, and printers. Internet services not yet introduced in the schools and power supply was not regular in most schools.

The study further revealed that BST teachers in Abuja have high self-efficacy in teaching BST subjects in Abuja because, they have high self-efficacy in solving problems associated with their teaching, they can establish routines to keep their activities running smoothly, they can establish a classroom management system with each group of students. The outcome of the study agrees with Birisci, S. and Kul, E. (2019). who asserted that highly efficacious individuals are more likely to set up more challenging goals, tend to be more resilient and experience fewer negative emotions in the process of achieving these goals. Granziera & Perera (2019) reported that teachers with higher self-efficacy are more likely to feel engaged with students or established routine to keep teaching activities running smoothly and experience more job satisfaction.

From the data analyzed, it was also revealed that teachers have high self-efficacy in utilizing ICTs for teaching BST in Abuja. This finding is in support of DiGregorio and Liston (2018) that teachers with higher ICT self-efficacy are most likely to use ICTs in their classrooms and are least likely to suffer from ICT-related anxiety. Siyam (2019) reported high levels of teachers' self-efficacy increase the use of ICTs in the

classrooms. Thus, teachers' technology or ICT self-efficacy is a significant predictor of the teachers' use of ICTs Hatlevik, I. K. R., & Hatlevik, O. E. (2018).

The difference in the teachers' self-efficacy in utilizing ICTs for teaching BST in Abuja, was such that self-efficacy have great impact on the utilization of ICTs for teaching between the teachers. The gender difference on the teacher's self-efficacy on ICT utilization for teaching in Abuja was research question 3 and hypothesis 1. From the analyzed data, it was deduced that there was a significant difference between male and female Basic Science and Technology teachers' self-efficacy in the use of ICT tool for teaching. This implies that gender is one of the factors that affects teachers' self-efficacy in the use of ICTs for teaching BST. The outcome of this finding supports the study of (Šabić et al., 2021) which reported that gender difference influenced technology use, in which male teachers' self-efficacy is higher than that of female teachers in the use of ICT.

From the analyzed data, it was established that there was significant difference in the basic science and technology teachers' self-efficacy in the use of ICT tools in teaching based on years of experience. This implies that respondents' expression on their self-efficacy in the use of ICT tools were different based on their years of experience. The Scheffe post-hoc result revealed that respondents with 20 years and above teaching experience contributed more to the significant difference. The finding relates to the study of Cavanagh, M. S. and Ma (2018) which revealed that teachers with longer years of working experience utilize ICTs less. Also, Kazan, S., and ELDaou, B. (2016) noted a significant difference between the less experienced and the experienced teachers in the utilization of ICTs. However, the less experienced teachers were found to be doing better in utilization of ICTs for academic purposes.

Conclusion

As technology continues to shape the educational landscape, understanding the role of technology professional development in enhancing teachers' self-efficacy is of paramount importance. This study contributes to the existing body of knowledge by shedding light on the intricate relationship between training and self-efficacy in the context of utilizing ICT for teaching basic science and technology. By addressing the gap between technological potential and effective implementation, educators can better prepare the next generation for the challenges and opportunities of the modern world. The results obtained from data gathered and analyzed in this study revealed that majority of the ICTs that are available for teaching BST in Abuja are printer; desktop computer; photocopier; flash drives; CDs/DVDs; laptops; and scanner however, tools like educational software; virtual library; internet; projector; radio; digital camera; and interactive white board are inadequate for use. Basic Science and Technology teachers in Abuja have high self-efficacy in teaching BST subjects. It was found that basic science and technology have high self-efficacy in utilizing ICTs to support their teaching in Abuja which shows a positive progression in the acceptance of educational innovations.

However, there was significant difference between male and female Basic Science and Technology teachers' self-efficacy in the use of ICTs for teaching. Also, a significant difference was found in the basic science and technology teachers' self-efficacy in the use of ICTs in teaching based on years of experience. Conclusively, the

study revealed that teachers with higher years of teaching experience had low level of utilization of ICTs in teaching compared to those with less years of teaching experiences and there was also a significant difference on teachers’ utilization of ICTs based on teaching subject in Abuja.

Recommendations

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

1. The study recommended that adequate ICTs, including the internet, should be provided to aid the use for teaching.
2. Regular workshops aimed at increasing teachers’ level of utilization of these tools in teaching should be organized. The workshop and training programs should also aim at sensitizing teachers on the importance of using ICT tools as it promotes students’ learning and enhance their academic achievement. Special interest should be on teachers with greater years of teaching.
3. Female teachers in secondary schools should be encouraged to integrate the available ICTs for instruction like their male counterparts.
4. Institutional administrators should include the provision of ICT facilities that will enhance instruction and research for the lecturers, learning and research for the students.
5. Science teachers should be equally and adequately exposed to the digital curriculum with the same kind of ICTs to acquire skills and knowledge for effective teaching and learning.

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