IMPACT OF TEACHER PROFESSIONAL DEVELOPMENT PROGRAMMES ON SCIENCE LECTURERS' KNOWLEDGE AND USE OF MODERN TECHNOLOGIES IN TEACHINGIN TERTIARY INSTITUTIONS

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Abstract

Teacher Professional Development Programme (TPDP) refers to a wide variety of specialized training, formal education, or advanced professional learning intended to help teachers to improve on their professional knowledge, competence, skill, and effectiveness. This study examined the impact of a TPDP on male and female science lecturers' levels of knowledge and extent of utilisation of modern technologies in teaching in the tertiary institutions. The study adopted a descriptive survey design. The population was 457 Science lecturers from three tertiary institutions in Ebonyi State, who had participated in a TPDP – Advanced Digital Appreciation Programme for Tertiary Institutions (ADAPTI) from 2015 to 2018. The sample was 125 lecturers (72 males and 53 females) drawn from the population through stratified random sampling technique. A researcher-made structured questionnaire was used for data collection, which was validated by three experts in Science Education. Cronbach Alpha was used to determine the internal consistency of the items, with reliability indices of .81 and .78 for clusters A and B of the questionnaire respectively, and .76 for the two clusters combined. Data obtained were analysed qualitatively and quantitatively. Findings of the study revealed that after the TPDP, the lecturers 'levels of knowledge of modern technologies increased, however, their extent of utilisation of these technologies in teaching was still low. The study further found no significant difference in the male and female lecturers' knowledge and use of modern technologies in teaching after the TPDP. The researcher recommended, among others, that tertiary institutions should regularly engage their lecturers in TPDP for effective utilization of modern technologies in teaching, for enhanced students' academic performance.

Introduction

Professional development according to Speck and Knipe (2005) generally refers to learning to earn or maintain professional credentials,

ranging from academic degrees to formal coursework, attending conferences, and informal learning opportunities situated in practice. Continuing, Speck and Knipe described professional development as intensive and collaborative, ideally incorporating an evaluative stage. There are a variety of approaches to professional development, including consultation, coaching, communities of practice, lesson study, mentoring, reflective supervision and technical assistance (National Professional Development Centre on Inclusion, NPDCI, 2008). Meanwhile, in education, professional development may be referred to as a wide variety of specialized training, formal education, or advanced professional learning intended to help administrators, teachers, and other educators improve their professional knowledge, competence, skill, and effectiveness (Glossary of Educational Reform, 2013).Continuing, the Glossary maintained that in practice, professional development for educators encompasses an extremely broad range of topics and formats. They may range from a one-day conference to a two-week workshop to a multi-year advanced-degree program. They may be delivered in person or online, during the school day or outside of normal school hours, and through one-on-one interactions or in group situations. Similarly, the Organisation for Economic Cooperation and Development, OECD, (2009), added that teachers' professional development programmes are activities that develop an individual's skills, knowledge, expertise and other characteristics as a teacher. Continuing, OECD maintained that teachers' professional development can be provided in many ways, ranging from the formal to the informal. It can be made available through external expertise in the form of courses, workshops or formal qualification programmes, through collaboration between schools or teachers across schools or within the schools in which teachers work. Also, teachers' professional development programs may be led and facilitated by educators within a school or provided by outside consultants or organizations hired by a school or institution.

Recently, many Nigerian Universities through the Tertiary Education Trust Fund (TETFund) and the Nigerian Communications Commission (NCC) have extensively invested in modern technology facilities. However, installing these modern technological facilities in the schools do not necessarily mean that these facilities are being integrated into teaching and learning processes by the teachers (Hennessy, Ruthven, & Brindley, 2005). Most lecturers (teachers) fail to integrate these modern technologies into their courses (Goktaş, Yıldırım, & Yıldırım, 2008). However, TPD Pmay help the lecturers to integrate modern technologies into their teaching and learning processes. Studies have shown that in various countries teachers' professional development programs are widely used to enhance modern technology

integration in education (McCarney, 2004). Therefore, this evaluation of the impact of teachers' professional development programmeson science teachers' knowledge and use of modern technologies might offer a route map for the new steps of enhancing the teachers' knowledge and use of modern technologies to improve students' academic performance. Hence, this study is aimed at investigating the impact of teachers' professional development programme (Advanced Digital Appreciation Programme for Tertiary Institutions - ADAPTI) on science teachers' knowledge and use of modern technologies in teaching and learning in tertiary institutions in Nigeria.

Meanwhile, modern technology refers to advancements in the methods and tools used to solve problems or achieve a goal. Modern technology, today, plays a very important role in our lives. It is seen as a basis of growth of an economy. An economy which is poor in technology can never grow in today's scenario. This is because technology makes our work much easier and less time-consuming. The impact of technology can be felt in every possible field one of such field is education. Meanwhile, the effective use of technology in education has changed the face of education and it has created more educational opportunities. Both teachers and students have benefited from various educational technologies, teachers have learned how to integrate technology in their classrooms and students are getting more interested in learning with technology (Karehka, 2013). Continuing, Karehka emphasized that the use of technology in education has removed educational boundaries, both students and teachers can collaborate in real-time using advanced educational technologies. In the classroom, technology can encompass all kinds of tools from low-tech pencil, paper, and chalkboard, to the use of presentation software, or high-tech tablets, online collaboration and conferencing tools, and more (Centre for Teaching and Learning, 2019).Furthermore, modern technology can be a powerful teaching and learning tool, both in terms of pedagogical resources and in terms of connectivity. Personal computing and the internet, in particular, have changed the world. However, modern technology cannot be effective in the classroom without teachers who are knowledgeable about both the technology itself and its implementation to meet educational goals. Besides, teaching is all about introducing students to a whole world of concepts that they didn't know about yet. So, modern technology in the classroom can be likened to a foray into modern invention – and the teacher gets to be the expedition leader. Therefore, rather than viewing modern technologies such as digital devices and internet spaces as a threat to their duties, the teachers should view them as unexplored areas of growth for both themselves and the young minds trusting them to be shown what's out there (Lynch, 2017).

Contributing, the U.S. Department of Education (2011) added that modern technology ushers in fundamental structural changes that can be integral to achieving significant improvements in productivity. Used to support both teaching and learning, modern technology infuses classrooms with digital learning tools, such as computers and handheld devices; expands course offerings, experiences, and learning materials; supports round the clock learning; builds 21st-century skills; increases student engagement and motivation; and accelerates learning. Continuing, the U.S. Department emphasized that modern technology also has the power to transform teaching by ushering in a new model of connected teaching, which links teachers to their students and to professional content, resources, and systems to help them improve their instruction and personalize learning. Furthermore, online learning opportunities and the use of open educational resources and other modern technologies can increase education by accelerating the rate of learning, reducing costs associated with instructional materials or program delivery, and better-utilizing teacher time.

From the foregoing, modern technologies are seen as vital tools in the teaching and learning processes. The teachers should endeavour to incorporate these modern technologies into their classrooms for enhancing students' academic achievement and retention of concepts learnt.

Moreover, modern technologies offer numerous innovative tools that science teachers can use to enhance their students' learning experience and academic performance. However, it is important to note that teaching with technology is not only about keeping up to date of all the latest teaching tools available, but also about knowing how to effectively integrate them into science teaching(Global, 2019).Continuing, Global maintained that although it is natural to consider these tools as a starting point, the use of modern technologies in science teaching is more likely to be appropriate and effective when the integration involves a process of careful planning. However, to be able to integrate modern technologies into science teaching and learning more effectively, and maximise the benefits on the students, teachers/instructors need to evaluate the course goals/objectives as they do when planning a new course. They need to determine what they will expect their students to learn from the course, and the knowledge and skills they want them to acquire at the end of the lesson. With these, they can design appropriate learning activities and suitable technologies that will help students reach their goals.

Furthermore, the Centre for Teaching and Learning (2019) identified the following modern technology tools that will help in the effective teaching and learning of science for enhanced students' academic performance.

Online collaboration tools (*such as those in* Google Apps): These allow students and teachers/instructors to share documents online, edit them in real-time and project them on a screen. This gives students a collaborative platform in which to brainstorm ideas and document their work using text and images.

Presentation software (such as PowerPoint*)*: These enable teachers/instructors to embed high-resolution photographs, diagrams, videos and sound files to augment the text and verbal lecture contents.

Tablets: These can be linked to computers, projectors and the cloud so that students and instructors can communicate through text, drawings and diagrams.

Course management tools (*such as Canvas)*: These allow teachers/instructors to organize all the resources students need for a class (e.g. syllabi, assignments, readings, online quizzes), provide valuable grading tools, and create spaces for discussion, document sharing, and video and audio commentary. All courses are automatically given a Canvas site!

Clickers and smartphones: These are quick and easy ways to survey students during class. This is great for instant polling, which can quickly assess students' understanding and help instructors adjust pace and content.

Lecture-capture tools (*such as Panopto*):These allow teachers/instructors to record lectures directly from their computer, without elaborate or additional classroom equipment. Lectures are recorded by the teacher and then uploaded for the students to re-watch. Studies show that posting recorded lectures *does not* diminish attendance and students appreciate the opportunity to review lectures at their own pace.

Furthermore, it is important to point out that the use of modern technologies in science teaching must go beyond just knowing how to work with certain software or apps, but teachers also need to understand ways in which such new tools can make a huge impact on science students 'learning. One of the ways of achieving this can be through the constant engagement of the teachers in professional development programmes.

Teacher professional development programmeis some form of an educational programme for teachers that can enhance or better their teaching or classroom environment. No matter how good pre-service training for teachers is, it cannot be expected to prepare teachers for all the challenges they will face throughout their careers. Education systems, therefore, seek to provide teachers with opportunities for in-service professional development to maintain a high standard of teaching and to retain a high-quality teacher workforce (OECD, 2009).

Some professional development workshops are an hour or two, while others may be a week-long, some may be longer than a week. These workshops or clinics are most effective when they are in the teacher's subject area. However, teachers can learn the use of modern technologies and overall strategies for classroom management that can benefit any topic in any age group.

Continuing, OECD (2009) outlined the following as the objectives of teachers' professional development programmes. The objectives are to: "update individual teachers' knowledge of a subject in light of recent advances in the area; update individual teachers' skills, attitudes and approaches in light of the development of new teaching techniques and objectives, the use of new technologies in teaching and learning, new circumstances and new educational research; enable individual teachers to apply changes made to curricula or other aspects of teaching practice; enable schools to develop and apply new strategies concerning the curriculum and other aspects of teaching practice; exchange information and expertise among teachers and others, e.g. academics, industrialists; and help weaker teachers become more effective." Pg. 49.

From the foregoing, the objectives of teachers' professional development programs are quite laudable. It, therefore, becomes imperative that every teacher should be encouraged to participate in professional development programmes, especially, the ones designed for training on the use of modern technologies in teaching and learning.

Furthermore, this study evaluated the impact of Advanced Digital Appreciation Program for Tertiary Institutions (ADAPTI) on science teachers' knowledge and use of modern technologies in teaching and learning in tertiary institutions.

The Advanced Digital Appreciation Programme for Tertiary Institutions (ADAPTI) is a professional development program facilitated by the Digital Bridge Institute (DBI) a subsidiary of the Nigerian Communications Commission (NCC). The ADAPTI is a unique platform that targets the academic and non-academic staff of tertiary institutions for training on the proficient use of modern technologies such as basic ICT office productivity tools, including the internet, use of e-teaching and e-learning facilities as well as collaborations in course delivery for enhanced e-teaching and learning (Digital Bridge Institute, DBI, 2018). Continuing, DBI emphasized that ADAPTI equips participants with these essential modern technology skills through hands-on training and learning approach so that they could translate the acquired acknowledge and skills to improve teaching, research and work performance. The ADAPTI contents were structured in

modules. The modules contained the following topics: Introduction to Information and Communication Technology (ICT); MS Word; MS Excel; MS Power-point; and Introduction to the Internet. During the training programme, rather than being passive learners, teachers were usually actively involved in specific tasks which they could readily transfer to their teaching. The ADAPTI exposes the teachers to learn how to integrate modern technologies into their science classrooms. It also enables the teachers to create modules with interactive computer animations and power-point presentations for different science subjects during the TPDP.

Meanwhile, the National Research Council (1996) emphasized that in the 21st century, teaching and learning require teachers to take advantage of the unique features of modern technologies and to implement same in their instructions for learners. Moreso, teachers are expected to utilize these modern technological advancements for effective teaching and learning processes (Law, 2008; Thomas & Knezek, 2008). However, studies have shown that the teachers are not utilizing, nor integrating these modern technologies in their classrooms. Specifically, Tüy (2003) in Nagiham (2016),found that teachers' level of modern technology use and integration are very low. Also, the low level of utilisation of modern technology by teachers can be attributed to lack of knowledge and expertise to effectively use these technologies. Similarly, Kurt (2014) found that teachers did not successfully integrate technology into their teaching. Besides, Becker, Ravitz and Wong (1999)noted that teachers may not be well prepared for using these technologies even if they have access to modern technologies in their classrooms.

Furthermore, Dickson and Irvin (2002), and Chen (2008)in their separate studies revealed that although integration of technology into education is regarded as highly important for improving teaching, teachers are not always utilizing these modern technologies. Meanwhile, Cavas, Cavas, Karaoglan and Kisla(2009), stressed that the problem of low or non-utilisation of modern technologies by teachers primarily depends on lack of effective training. They added that teachers should be constantly trained on how to use these modern technologies and integrate the same into their instructional processes through teacher professional development programmes (TPDPs).

Besides, several studies have proven that professional development programmes increase teachers' knowledge and use of modern technologies in teaching and learning. Specifically, Giordano (2008) found that, at the end of the professional development programme, teachers began to use the internet for instructional purposes and later on this usage became permanent. Similarly, Lavonen, Juuti, Aksela, and Meisalo (2006) found that, after the professional development programme, technology usage skills of science

teachers increased and they were able to integrate the technology with the learning environments. Furthermore, Voogt, Almekinders, van den Akker, and Moonen (2005) found that, after completing professional development programme, teachers' attitude towards the use ofmodern technologies (computer) was changed positively. They added that at the end of the professional development programme, the teachers' skills in the use of modern technology increased and the teachers started to integrate ICT into their teaching and learning environments.

However, other studies have shown that, while professional development program increases the teachers' acquisition of modern technology skills, the teachers' use of modern technologies in teaching and learning was still very low (Brinkerhoff, 2006). A study by Frankoli and Hammond (2007) found that teacher professional development programme induced a positive impact not only on developing the modern technology skills of teachers but also on their familiarity with technology as a curricular tool to some degree, however, it had a very limited impact on the classroom practice. Similarly, Glazer, Hannafin, Polly, and Rich (2009) found that, while most of the teachers who participated in a professional development programme, expanded their knowledge, skills, ideas, and their lesson plan repertoire through these learning experiences, only one-third of them were considered as proficient apprentices at the end of the study. Meanwhile, Yurdakul, et. al.**(**2010**)**in Nagim (2016**)**also revealed that professional development programme was capable of increasing the teachers' modern technology usage skills, whereas it failed to induce substantial change for the technology integration.

From the foregoing, it can be established that while teachers' professional development programs have enhanced teachers' acquisition of skills for the use of modern technologies, the continuous utilisation of these modern technologies in the teaching and learning of science by the teachers have not been fully achieved. Meanwhile, none of the studies cited above was conducted in the area of this present study. Hence the justification for this present study.

The main purpose of this study is to evaluate the impact of teacher professional development programmes on science teachers' knowledge and use of modern technologies in teaching in tertiary institutions. Specifically, the study sought to determine the;

- Impact of ADAPTI on the male and female science lecturers' levels of knowledge of modern technologies in teaching in the tertiary institutions.

- Impact of ADAPTI on the male and female science lecturers 'extent of utilisation of modern technologies in teaching in the tertiary institutions.

The following research questions and hypothesis guided the study;

- What is the difference in the male and female science lecturers' opinions on the impact of ADAPTI on the levels of knowledge of modern technologies in teaching in the tertiary institutions?
- What is the difference in the male and female science lecturers' opinions on the impact of ADAPTI on their extent of utilisation of modern technologies in teaching in the tertiary institutions?
- There is no statistically significant difference between the male and female science lecturers' opinions on the impact of ADAPTI on their levels of knowledge of modern technologies in teaching in the tertiary institutions.
- There is no statistically significant difference between the male and female science lecturers' opinions on the impact of ADAPTI on their extent of utilisation of modern technologies in teaching in the tertiary institutions.

Method

This study adopted a descriptive survey design. The area of the study was Ebonyi State. The population was 457 Science lecturers from three tertiary institutions (2 Universities and 1 College of Education) in Ebonyi State, who had participated in a professional development programme – Advanced Digital Appreciation Programme for Tertiary Institutions (ADAPTI) from 2015 to 2018. The sample was 125 lecturers (72 males and 53 females) drawn from the population through stratified random sampling technique. The instrument for data collection was a researcher-made structured questionnaire with a five-point Likert rating scale of Strongly Agree (SA), Agree (A), Undecided (U), Disagree (D), and Strongly Disagree (SD), weighted as follows; 5, 4, 3, 2, and 1 accordingly for the two research questions. The part A of the questionnaire sought information on the personal data of the respondents, while the part B comprised twenty (20) items on the impact of teacher professional development programmes on science teachers' knowledge and use of modern technologies in teaching in the tertiary institutions. Validation of the instrument was done by three experts in Science Education. Cronbach Alpha was used to determine the internal consistency of the items. This involved the conduct of a pilot study with a sample of thirty science lecturers randomly selected another University outside the study area.

In the end, reliability indices of 0.81 and 0.79 were obtained for clusters A and B of the instrument respectively, with an overall reliability coefficient of 0.80 for all the clusters. This was considered high enough for the study. All the 125 copies of the questionnaire were distributed to the respondents by the researcher, through the help of some assistants from the various institutions. All the questionnaires were returned giving a 100% return rate. Mean with standard deviation was used to analyse data, while the hypotheses were tested using t-test statistics at .05 probability level. The decision rule was that any item with mean score ≥ 3.00 was interpreted "Agree"(A),while any with mean score< 3.00 was interpreted "Disagree" (D). For the hypotheses, if the calculated t-value was greater than or equal to the t-critical value, the null hypothesis was rejected. If the calculated t-value was less than the t-critical, the null hypothesis was accepted.

Results

Table 1: Mean and Standard Deviation Scores of Male and Female Science Lecturers' Levels of Knowledge of Modern Technologies in Teaching

S/N	Item Statement	Male N = 72			Female N = 53		
		$\bar{X}$	SD	Dec.	$\bar{X}$	SD	Dec.
1	The ADAPTI training program broadened my knowledge of modern technologies in education	3.82	1.26	A	3.57	1.40	A
2.	After the ADAPTI programme, I now have a better knowledge of the Internet and the web	3.61	1.45	A	3.51	1.51	A
3.	The professional development program helped me to acquire the knowledge and skill of Power-point presentation	3.60	1.37	A	3.58	1.37	A
4.	The ADAPTI program helped me to acquire the knowledge and skill of Microsoft word package	3.47	1.34	A	3.10	1.35	A
5.	The training program exposed me to the knowledge and skill of Microsoft Excel and other spreadsheet packages	3.67	1.35	A	3.68	1.34	A
6.	The ADAPTI program exposed me to the knowledge and skills of computer animation, graphics and simulation	2.92	1.31	D	2.75	1.32	D
7.	The program has exposed me to the knowledge and skill of assessing online teaching resources and information	3.72	1.30	A	3.43	1.40	A

8	I acquired the knowledge and skill of the use of multimedia projector after the ADAPTI training	3.47	1.34	A	3.47	1.35	A
9.	The training program enabled me to acquire knowledge and skill of assessment of student's academic progress using modern technology	3.63	1.29	A	3.64	1.26	A
10.	The ADAPTI program enabled me to acquire the knowledge and skill of using technology assistive packages such as podcasts, video conferencing, etc.	2.94	1.24	D	2.89	1.33	D
	Total	**3.48**	**1.36**	**A**	**3.40**	**1.40**	**A**
	Grand Total	**3.45**	**1.38**	**A**			

From Table 1, it is observed that the male and female science lecturers' responses on their knowledge of modern technologies used in teaching and learning in tertiary Institutions have overall mean score of 3.45 with a standard deviation of 1.38. The table also shows that the mean response scores of the lecturers in 8 of the 10 items were higher than the benchmark of 3.0. This, therefore, implies that the science lecturers had better knowledge and understanding of modern technologies used in teaching and learning after the ADAPTI professional training programme. Furthermore, from the table, the total mean response score of male science lecturers was 3.48 with a standard deviation of 1.36, while that of the female science lecturers was 3.40 with a standard deviation of 1.40. This shows a slight difference of 0.08 in the mean responses of the male and female science lecturers.

However, the table did not show whether the observed difference was statistically significant or not. To ascertain the significance or otherwise of the observed difference, the result was subjected to inferential testing as hereunder shown in hypothesis 1. Meanwhile, the standard deviation of the female science lecturers was 1.40, which was slightly higher than 1.36 obtained by the male science lecturers. The lower standard deviation shows that the male science lecturers' responses were more clustered around the mean than that of their female counterparts.

Table 2: t-test Analysis of the Mean Responses of Male and Female Science Lecturers

Gender	N	$\overline{X}$	SD	Df	t-cal.	t-crit.	Decision
Male	72	3.48	1.36	123	0.32	1.96	Do not Reject Ho
Female	53	3.40	1.40				

N = No. of subjects; $\overline{X}$ = Mean; SD = Standard deviation; df = Degree of freedom

Table 2 shows that the calculated t-value, at .05 level of significance and 123 degree of freedom, was 0.32which was less than the critical t-value of 1.96. Thus, the null hypothesis was accepted. This means that there was no statistically significant difference in the male and female science lecturers' perceptions on the impact of ADAPTI on their levels of knowledge of modern technologies in teaching in the tertiary institutions. This shows that the ADAPTI had the same impact on the male and female science lecturers' levels of knowledge of modern technologies after the programme.

Table 3:Mean and Standard Deviation Scores of Male and Female Science Lecturers' Responses on the Extent of Utilisation of Modern Technologies in Teaching

S/N	Item Statement	Male	N = 72		Female	N = 53	
	After the ADAPTI training program, I now utilise;	$\bar{X}$	SD	Dec.	$\bar{X}$	SD	Dec.
1	internet to search and access online science teaching resources.	3.53	1.31	A	3.30	1.40	A
2.	computer animations and simulations to demonstrate difficult concepts in science.	2.67	1.34	D	2,74	1.40	D
3.	MS Word and Power Point presentations in science lesson delivery.	3.47	1.40	A	3.45	1.39	A
4.	Microsoft Excel package for processing students' results and other spreadsheet applications.	3.40	1.38	A	3.40	1.37	A
5.	the multimedia projector in the classroom during science lesson delivery.	2.74	1.30	D	2.74	1.31	D
6.	modern technology in the assessment of my student's academic progress.	2.90	1.46	D	2.77	1.45	D
7.	modern technology assistive packages such as podcasts, video conferencing to improve science instruction in the classroom.	2.47	1.17	D	2,62	1.29	D
8	modern technology to communicate and collaborate with students and other teachers, beyond the classroom.	3.54	1.32	A	3.58	1.34	A
9.	modern technology to create new ideas and representations of scientific information.	2.63	1.29	D	2.60	1.29	D
10.	modern technology in assisting students to identify and solve scientific problems.	2.94	1.48	D	2.98	1.47	D
	Total	**3.03**	**1.40**	**A**	**3.02**	**1.42**	**A**
	Grand Total	**3.03**	**1.41**	**A**			

Table 3 indicates that the total mean responses of the male and female science lecturers were 3.03 with a standard deviation of 1.41. The total mean score was slightly higher than the benchmark. This shows that science lecturers generally utilised modern technologies in teaching and learning after the ADAPTI training programme. However, the table shows further that the mean response scores of the science lecturers in 6 of the 10 items were lower than the benchmark of 3.0. This implies that science lecturers do not utilise all the identified modern technologies in teaching. Furthermore, the table shows that the overall mean response score of male science lecturers was 3.03 with a standard deviation of 1.40 while that of their female counterparts was 3.02 with a standard deviation of 1.42. This shows as light difference of 0.01between the male and female science lecturers' overall mean response scores. However, the table did not show whether the observed slight difference was statistically significant or not. To ascertain the significance or otherwise of the observed difference, the result was subjected to inferential testing as hereunder shown in hypothesis 2. Moreover, the standard deviation of the female science lecturers was 1.42, which was slightly higher than 1.40 obtained by the male science lecturers. This shows that the male science lecturers' opinions were more clustered around the mean than that of their female counterparts.

Hypothesis 2: There is no statistically significant difference between the male and female science lecturers' opinions on the impact of ADAPTI on their extent of utilisation of modern technologies in teaching in the tertiary institutions.

Table 4:t-test Analysis of the Mean Responses of Male and Female Science Teachers

Gender	N	$\overline{X}$	SD	Df	t-cal.	t-crit.	Decision
Male	72	3.03	1.40	123	0.39	1.96	Do not Reject Ho
Female	53	3.02	1.42				

N = No. of subjects; $\overline{X}$ = Mean; SD = Standard deviation; df = Degree of freedom

From Table 4, the calculated t-value at .05 level of significance and 123 degree of freedom was .39which was less than the critical t-value of 1.96. Therefore, the null hypothesis was accepted. This means that there was no significant difference in the responses of the male and female science lecturers on the extent of utilisation of modern technologies in teaching after the ADAPTI training programme. This shows that the ADAPTI had the same

impact on the male and female science lecturers' extent of utilisation of modern technologies after the programme.

Discussion

The findings of this study have shown that after the professional development programme, specifically, the ADAPTI, the lecturers gained more knowledge and understanding of the basic skills of utilising modern technologies in teaching and learning of science subjects/courses. This finding is in line with Giordano (2008) who found that, at the end of the professional development programme, teachers' knowledge on the use of modern technologies such as the internet for instructional purposes increased.

The finding was also supported by the findings of Lavonen, Juuti, Aksela, and Meisalo (2006), that after the professional development programme, technology usage skills of science teachers increased and they were able to integrate the technology with the learning environments. Similarly, the finding is in line with Voogt, Almekinders, van den Akker, and Moonen (2005) who found that, after completing professional development programme, teachers' attitude towards the use of modern technologies (computer) was changed positively and increased. From the foregoing, teachers' professional development programme can be seen as a vital ingredient needed for the enhancement of in-service teachers' effectiveness in the teaching and learning processes at all levels of education in Nigeria.

Furthermore, the finding of this study also revealed that after the ADAPTI training programme, the science lecturers began to utilise some of the identified modern technologies in their teaching and learning processes. This finding agrees with the findings of Giordano (2008) and Lavonen, Juuti, Aksela, and Meisalo (2006) who found that, at the end of the professional development programme, teachers began to use the internet for instructional purposes and later on the usage became permanent. Moreover, this study further found that science lecturers were not utilising most of the modern technologies in their teaching processes. This finding is in line with Brinkerhoff (2006),Frankoli and Hammond (2007), Glazer, Hannafin, Polly, and Rich (2009) who in their separate studies found that although professional development programme increases the teachers' acquisition of modern technology skills, the teachers' use of modern technologies in teaching and learning was still very low and had a very limited impact on the classroom practice. This study has shown that although professional development programmes increased the lecturers' level of knowledge of modern technologies, however, the extent of utilisation of these modern technologies in the teaching processes was still very low. Meanwhile, the low utilization of

modern technologies, even after the TPDP can be attributed to many factors, including the non-availability of modern technologies especially computers; erratic power supply; lack of internet access in the schools; high cost of internet connectivity, etc. These factors are hampering the effective utilization of modern technologies in the teaching and learning processes in most tertiary institutions in the developing countries, including Nigeria (Ayoub, Petra,& Joke, 2016).

This study has shown that there was no significant difference in the mean perception scores of the male and female science lecturers' levels of knowledge, as well as the extent of utilisation of modern technologies in teaching in the tertiary institutions in Nigeria. This implies that the professional development programme had a similar impact on both male and female science lecturers regardless of their gender.

Conclusion

This study has shown that the use of modern technologies in teaching in Nigerian tertiary institutions is very vital for the enhancement of teaching and learning. This is based on the fact that modern technologies support both teaching and learning processes, by digitizing classrooms through digital learning tools like computers, smartphones, smart digital whiteboards, etc. Modern technology has expanded course offerings, increased student's engagement and motivation towards learning. The lecturers should, therefore, integrate modern technologies into their teaching processes in the higher institutions in Nigeria. Meanwhile, it should be noted that teaching with technologies does not only involve keeping up to date of all the latest modern teaching tools available but also involve effectively utilisation and integration of these modern technologies into science teaching. This can be achieved by exposing the teachers to professional development programmes on the use of modern technologies. This study has established the fact that professional development programmes enhance lecturers' acquisition of knowledge, skills and utilisation of modern technologies.

Recommendations

Based on the findings of the study, the researcher made the following recommendations;

- Tertiary institutions should regularly engage their lecturers in professional development training programmes for effective utilization of modern technologies in teaching for enhanced students' academic performance.

- The management of tertiary institutions should embark on regular supervision of lecturers after professional development programs for effective implementation.
- The lecturers should be assisted to procure modern technologies, such as laptop computers, internet access, constant power supply, etc. to make for easy application of what they learnt, for effective teaching and learning.

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