



# **ASSEREN**

## **JOURNAL OF EDUCATIONAL RESEARCH AND DEVELOPMENT (AJERD)**

**VOL. 9, JULY 2022    ISSN 2536-6899    E - ISSN: 2814 - 3248**  
**Website: [www.theasseren.org.ng](http://www.theasseren.org.ng)**

# EVALUATION OF THE IMPACT OF IN-SERVICE TRAINING PROGRAMME ON SECONDARY SCHOOL MATHEMATICS TEACHERS' PEDAGOGICAL SKILLS AND UTILIZATION OF TECHNOLOGY IN AKWA IBOM STATE

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Submitted: 09 April, 2021 Revised: 05 May, 2022 Accepted: 07 June, 2022

## Abstract

Poor academic performance in Mathematics among secondary school students have over the years, been a serious challenge in the educational system. This has been attributed to teachers' teaching effectiveness among many other factors. For this reason, many in-service training programmes for mathematics teachers have been ongoing in order to help enhance their teaching effectiveness. This paper sort to evaluate the impact of in-service training programme on upper basic Mathematics teachers' pedagogical skills and their utilization of technology. The study adopted a descriptive survey research design and employed stratified and simple random sampling techniques to select 134 Mathematics teachers from a population of 530 Mathematics teachers in public secondary schools in Akwa Ibom State, Nigeria. Two research questions and two instruments were used to gather relevant data for this study. These are; Mathematics Teachers' Observation Rating scale (MTORS) and Mathematics Teachers' Assessment Questionnaire (MTAQ). The instruments were validated by experts and trial tested and the reliability coefficient was estimate to be 0.89 through Cronbach-Alpha. The data collected was analyzed using descriptive statistics and one-sample (population)  $t$ -test statistics revealed  $t(133) = 92.78, p < .05$ ; critical  $t$ -value = 1.98 and  $t(133) = 1.87, p > .05$ ; critical  $t$ -value = 1.98 respectively. The results of the analysis revealed that the in-service training programme impacted Mathematics teachers' pedagogical skills but negatively in the use of technology. It was then recommended that, Mathematics teachers should encourage with regular training and provision of technologies that will help facilitate the appropriate delivery of Mathematics instructions.

**Keywords:** Pedagogical Skills, Mathematics teachers, utilization of technology, In- service training programme

## Introduction

The ability of secondary school students to understand and appreciate Mathematics has been a challenging issue and, this has led to the dwindling performance in Mathematics among them. In other to tackle this, policy makers are placing serious demands on Mathematics teachers for the effective use of research reform practices which includes; effective pedagogical skills and utilization of technology among many others. To this end, the Government of Nigeria admits to train teachers with emphasis on Mathematics teachers by organizing workshops, seminars, symposium and all other forms of trainings through National Teachers Institute (NTI), School Based Training (SBT), Mathematics Association of Nigeria (MAN), Strengthening Mathematics and Science Education (SMASE) Nigeria Project which is usually organized on a three-tier (National, State and Local) cascading system.

Teachers' in-service training, is a programme that helps in updating teachers' skill and knowledge for improving teaching and learning in schools. It is a vital tool for teachers to update their professionalism especially when faced with new challenges and changes in the educational system. In-service training is designed for the development of manpower in the school system and the educational enterprise (Osamwonyi, 2016). It is a programme for on-the-job employees in order to boast up their efficiency. As defined by United Nations Educational, Scientific and Cultural Organization (UNESCO, 2019). in-service training is a process by which teachers

~~engage~~ ~~upgrade~~ ~~and~~ ~~employment~~ ~~training~~ ~~use~~ ~~of~~ ~~technology~~ ~~has~~ ~~the~~ ~~under~~ ~~listed~~ ~~objectives~~ ~~which~~ ~~includes~~ ~~to~~;  
engage in further education to refresh or upgrade their professional knowledge, skills and practices in the course of their employment. According to (UBEC, 2014) the training in specific terms in relation to Mathematics teachers' pedagogical skills and use of technology has the under listed objectives which includes to;

1. Sharpen the teachers' skills and methodology
2. Improve the teachers' instructional skills and practices

It is believed that, the training will help to impact knowledge to Mathematics teachers in Akwa Ibom State for effective subject delivery that will help the students in content assimilation. Therefore, it is vital that Mathematics teachers whose subject is the basis of every other subject and a determinant of success to all kinds of profession be able to have comfortable control of the subject matter, be efficient and effective in all aspect of teaching processes to help achieve the set goals. No wonder, Ihajamaizu, Inyang and Adali (2016) added that, professional competence of Mathematics teachers that are constantly empowered in their teaching skills aid students' achievement levels of performance.

Mathematics as a subject plays a key role in shaping how an individual student is able to deal with the various spheres of private, social, and civil life. It develops critical and logical thinking in learners. Therefore, it behooves the teacher of Mathematics to be creative, resourceful and competent in classroom delivery and innovative technology since learners' success in Mathematics requires effective teaching as such demands that Mathematics teachers should acquire skills to bring about success. They should be able to possess some level of competences that will ensure quality standard in the teaching of Mathematic. Obanya (2014) and Asiyai (2015) stated that good quality of teachers will ultimately engender quality progress in the education industry.

Pedagogy may be regarded as the principles and method of teaching or practice of teaching profession. It is all about what a teacher does in the teaching profession such as; the act of imparting knowledge, skills and instructing. As viewed by Agbor (2016), this needs to be explored through the thinking and practice of those teachers who care, accompany learners, and thus, bringing learning into life. Pedagogically, Mathematics teacher is expected to have content knowledge of the subject and should be able impact it effectively by increasing the quality of instructions. Thus, a teacher of Mathematics then according to Encarta (2016), is somebody who teaches especially as a professional. He or she has a sole responsibility of importing knowledge and skills to the students in Mathematics (Olaitan, 2010).

A teacher who teaches Mathematics is therefore, someone who has acquired the basic knowledge and skills in Mathematics, and pedagogical skills, capable of changing the learners' behavior, skills and attitudes through instruction. In order to do this, the teacher requires planning, organizing, implementing and evaluating instruction for certification of the learners and benefit of the society. Becoming an effective teacher is a continuous process that stretches from pre-service experiences to end of the professional career. This is conceptually divided into two, pre-service and in-service teacher training and both activities should be viewed as seamless components of the same process. On the other hand, due to the poor output, Mathematics teachers are usually target of errors by the parents and adjudge as very incompetent in doing their jobs. In order to correct this perception of the society about the mathematics teachers, Mathematics teachers require capacity building.

Technology is known as scientific inventions or collection of techniques, skills, methods, and processes used in the production of services or tasks objectives accomplishment. Educational technology is an inclusive term for both the material tools and the theoretical

foundations for supporting learning and teaching. It is also anything that enhances classroom learning in the utilization of blended, face to face, or online learning (Wikipedia). Mareco (2017) highlighted some reasons technology should be embedded into classrooms. He advocated that bringing technology in classroom could help the teacher get connected with students; students can easily interact with their classmates and instructors; teachers and other faculty members will have the opportunity to develop their students' digital citizenship skills. That is, giving students the ability to use it correctly and responsively. Thus, making them to stay engaged; Mareco also viewed that introduction of technology into the system makes the students to be able to access the most up-to-date information quicker and easier than ever before. This makes the students to have access to an incredible number of new opportunities. Hence, the inception of modern technology in classrooms is of great help to the educational system today as this has been able to erode off the traditional passive teaching and learning style in schools. It has also enabled teachers to improve their instruction methods and personalize learning leaving the teachers as encouragers, advisers and coaches while the students become more responsible.

In line with this, Asowa, Alawa and Isiwu (2013), conducted a study, in-service training needs of teachers in school-based assessment, on fish production for enhancing students' academic achievement in senior secondary schools in Enugu State. The study adopted survey research design and a population of 484 Agricultural science teachers. Using simple random sampling technique, a sample size of 286 Agricultural science teachers were used. The data collected was analyzed and the result revealed that 14 out of 15 items had their need-performance gap values ranged from 0.38 to 1.34 and were positive. This implies that Agricultural science teachers need in-service training on all the 15 items for developing school-based assessment tool in fish

production to enhance students' academic performance.

Alkaria and Albassan (2017) conducted a study to examine the effect of in-service training of computer science teachers in scratch language using an electronic learning platform on acquiring programming skills and attitudes towards teaching programming. The sample of this study consisted of 40 middle school computer science teachers. The study tools consist of an achievement test in scratch programming language and a measure of attitudes towards programming instruction. Using pretest-post test design, the results showed that there were statistically significant differences between the achievement tests mean scores in favor of the experimental group that were trained using an electronic training platform. The results also showed a positive effect on attitudes toward teaching programming for the experimental group. Onasanya, Shehu, Ogunsanya and Adefuye (2011) study result showed that the level of computer literacy of the Science teachers examined was low, their level of utilization of ICT resources was also very low, and there was significant difference between the mean scores of male and female science teachers in level of computer literacy and utilization of ICT's but that the males outperformed their female counterparts in both although, their level is very low. According to the researchers, it is expected that all science teachers (especially the females) need to be motivated and provided with relevant ICT training experiences (at pre-service and in-service) in order to enhance their instructional delivery productively.

To ascertain all these worries concerning the utilization of modern technology, Mtebe, Mibwilo, and Kissaka (2016) were not left out. In view of these researchers examined factors affecting teachers' acceptance enhanced content using the extended unified theory of Acceptance and use of Technology (UTAUT2) as a research framework. A sample of 1,137 teachers out of 2,000 was collected and tested against the research model using regression

~~analysis~~ With exception of performance ~~expectancy~~, all other factors had a statistically significant effect it on teachers' acceptance and the use of the developed content. They reported that Tanzania is faced with a severe shortage of qualified in-service school science and mathematics teachers. That while science and Mathematics account for 46% of the curriculum, only 28% of teachers are qualified to teach these subjects. In order to overcome this challenge, the Ministry of Education and Vocational Training (MoEVT) implemented a project to use multimedia-enhanced content knowledge of science and Mathematics teachers from Secondary Schools in 19 selected centers country wide. However, the presence and availability of this content does not automatically guarantee that teachers will use this. For this content knowledge, they must be accepted and used by teachers in secondary schools. Due to their findings, Mtebe, Mbwilo and Kissaka proffers recommendations among others that government and other stakeholders can develop further from their findings to develop strategies that will promote acceptance and use of the developed content in secondary schools in Tanzania.

Again, McDongald (2013) in support of the study and discovery the use of new technologies among in-service Colombian ELT teachers gave a report on the impact of the masters in English language teaching with an emphasis on autonomous learning environments from the Universidad de la Sabana. It was reported, how graduates from 12 cities and from 9 departments in Colombia are using information and communication technologies (ICT) for English language learning in order to promote autonomy. The data that has been gathered thus far reveals that teachers are becoming much in accordance with their teaching context, the strengths and opportunities of ICT tools and their consequent improvement on language teaching, while promoting the development of autonomous learners. In view of this, the present study was conducted to investigate Mathematics teachers'

in-service training programme towards pedagogical skills and the use of technology in teaching Mathematics.

### Research questions

1. To what extent does in-service training programme improve teaching pedagogy of secondary school Mathematics teachers in Akwa Ibom State.?
2. To what extent does in-service training programme improve secondary school Mathematics teachers in the utilization of technology in Mathematics in Akwa Ibom State.

### Methodology

The study employed non-experimental design of survey research type. The target population of this study was 530 Mathematics teachers from the 25 Local Education Committees (LECs) present in the Akwa Ibom State. Using stratified random sampling technique and guided by a purposive sampling procedure, a sample size of 134 Mathematics teachers was sampled from 18 LECs out of the 25 for the study. The researchers first used simple random sampling technique (ballot method) to select the 18 LECs that was considered out of the 25 since all the 25 LECs had equal probability of being selected. This was followed by the use of stratified random sampling technique for the selection of 134 Mathematics teachers. In order to avoid selecting teachers who did not participate in the training and those who are still undergoing the training at the time of this study, purposive sampling procedure was employed in the process of sampling. Two research questions and two instruments were used to gather relevant data for this study, Mathematics Teachers' Observation Rating scale (MTORS) and Mathematics Teachers Assessment Questionnaire (MTAQ). The MTORS was used by the researcher to assess the mathematics teachers while the MTAQ was

used by the students to assess their mathematics teachers. The instruments were content validated by experts in Educational Measurement and Evaluation for their scrutiny and were implemented in the final their versions. The Cronbach Alpha method was used to establish the reliability, which gave coefficients of .70 and .84 respectively. Data collected were analyzed using descriptive statistics and one sample (population) t-test statistics at the significance level of .05 and the population mean of (15.00) which was obtained from the instrument.

**Results**

The results of this study were presented and interpreted against each research question.

**Research Question 1:** To what extent does in-service training programme improve teaching pedagogy of secondary school Mathematics teachers in Akwa Ibom State?

**Table 1:** Frequency, Percentage, Mean and Standard Deviation of Secondary School Mathematics Teachers' Teaching Pedagogies

S/N	Variable	SD		D		A		SA		$\bar{X}$	SD
		N	%	N	%	N	%	N	%		
1.	Secondary school Mathematics teacher demonstrate different methods in teaching Mathematics	1	0.7	4	3.0	62	46.3	67	50.0	3.45	.59
2.	Secondary school Mathematics teacher teaches with several relevant examples	2	1.5	5	3.7	58	43.3	69	51.5	3.44	.64
3.	Secondary school Mathematics teacher, gives different definitions about a particular topic	1	0.7	3	2.2	71	53.0	59	44.0	3.40	.57
4.	Secondary school Mathematics teacher, can teach for students to understand	1	0.7	3	2.2	70	52.2	60	44.8	3.41	.57
5.	Secondary school Mathematics teacher provides new strategies for Mathematics instructional delivery	2	1.5	4	3.0	63	47.0	65	48.5	3.42	.62
6.	Secondary school Mathematics teacher, reads verbatim from his/her note	75	56.0	55	41.0	3	2.2	1	0.7	3.52	.58

As presented in Table 1, the researchers and the students rating of secondary school Mathematics teachers was positive and high based on their responses by agreeing to five (items 1-5) out of the six items in the scale, the only item (item 6) which respondents showed

disagreement was negatively worded. Again, the mean values of the 6 items (3.45, 3.44, 3.40, 3.41, 3.42 and 3.52) as well as the aggregate mean (3.38) of all the items that measure the impact of the in-service training programme on the secondary school Mathematics teachers on

their teaching pedagogy are all greater than the average mean of 2.5. This implies that the in-service training programme is highly impactful on the secondary school Mathematics teachers in their teaching pedagogy.

To further establish whether the result is statistically significant one sample t-test was employed and presented in Table 2.

**Table 2:** One sample (population) t-test of Mathematics teachers' in-service training programme impact on their pedagogical skills

Variable	N	Mean	SD	t-value	Sig.
Sample mean	134	20.66	2.57	92.78	.000*
Population mean		15.00			

\* significant at 0.05 level; df = 133; critical t-value = 1.98

As presented in Table 3, the result was statistically significant  $t(133) = 92.78, p < .05$ ; critical t-value = 1.98 the sample mean of 20.66 was greater than the reference population mean of 15.00 at  $p < .05$ ;  $df = 133$ . The result shows that the calculated mean (20.66) was higher than the population means (15.00). Therefore, at t-calculated of 92.78, the result implies that the Mathematics teachers' in-service training programme has significantly impacted

teachers' teaching pedagogy in Akwa Ibom state to a high extent.

**Research Question 2:** To what extent does in-service training programme improve secondary school Mathematics teachers in the utilization of technology in Mathematics in Akwa Ibom State.

**Table 3:** Frequency, Percentage, Mean and Standard Deviation of Secondary School Mathematics Teachers' Utilization of Technology

S/N	Variable	SD		D		A		SA		$\bar{X}$	SD
		N	%	N	%	N	%	N	%		
1.	Secondary school Mathematics teacher use technology in teaching	65	48.5	55	41.0	1	.7	13	9.7	1.29	.60
2.	Secondary school Mathematics teacher uses mathematics laboratory equipment to teach	63	47.0	52	38.8	3	2.2	16	11.9	2.12	.66
3.	Secondary school Mathematics teacher utilize mathematics instructional technology	52	38.8	50	37.3	8	6.0	24	17.9	2.28	.71
4.	Secondary school Mathematics teacher uses mathematical gadgets to teach some topics	71	53.0	58	43.3	2	1.5	3	2.2	2.07	.88
5.	Secondary school Mathematics teacher uses visuals to teach mathematics	64	47.8	39	29.1	12	9.0	19	14.2	1.97	.89
6.	Secondary school Mathematics teacher uses projector to teach	61	45.5	41	30.6	13	9.7	19	14.2	1.97	.91

As presented in Table 3, the researchers and the students rating of secondary school Mathematics teachers was negative based on their responses by disagreeing to all the six items in this sub-scale. Again, the mean values of the 6 items (1.29, 2.12, 2.28, 2.07, 1.97 and 1.97) that measure the impact of the in-service training programme on the secondary school Mathematics teachers' utilization of technology are all less than the average mean of

2.5. This implies that the in-service training programme is not impactful on the secondary school Mathematics teachers' utilization of technology, may be simply because technological instruments was not available or, that the few there were not functioning.

To further establish whether the result is statistically significant, one sample t-test was employed and presented in Table 5.

**Table 4:** One Sample t-test of Secondary School Mathematics Teachers In-Service Training Programme Impact on Utilization of Technology

Variable	N	Mean	SD	t-value	Sig.
Sample mean	134	8.65	3.62	1.87	.071
Population mean		15.00			

**Not significant at 0.05 level; df = 133; critical t-value = 1.98**

As presented in Table 4, the result was not statistically significant  $t(133) = 1.87, p > .05$ ; critical t-value = 1.98. The sample mean of 8.65 was less than the reference/population mean of 15.00 at  $p > .05$ ;  $df = 133$ . The result shows that the calculated mean (8.65) was less than the population means (15.00). Therefore, at t-calculated of 1.87, the result implies that, the mathematics in-service training programme has not significantly improved teachers' ability to utilize technology in Akwa Ibom State to a high extent.

### Discussion

In-service training for Mathematics teachers on teaching pedagogies. Under this research question, Tables 1 and 2 present the results. Table 1, showed that the means of the 6 items measuring this research question and the aggregate mean of (3.38) when compared with the average mean (2.5) were higher than the average mean. This in turn shows that, in-service training programme was strongly impactful on Mathematics teachers in the aspect of their pedagogical skills. The impression here is that in- service training was able to impact a good number of Mathematics

teachers pedagogically positively due to the fact that, the sample mean (20.66) was greater than the population mean (15.00) and that, the t-calculated of 92.78 was > than t-critical of 1.98 at  $p < .05$  and  $df = 133$  as given in Table 2.

Duru and Arslan (2015) reported that one of the ways for teachers to improve classroom activities and students' achievement is to receive in-service training. Again, Jauhiainen, (2013) study on effects of an in-service training program on Physics teachers' pedagogy reported that within the framework of national science and Mathematics education development programme a long-term Physics teacher training programme was organized. The aim of the program was to enhance teachers' pedagogical content knowledge especially regarding the role of experiment in Physics education, which was discussed based on a practical teaching philosophy called exceptional approach. The research aimed at exploring teachers' experience of the training programme, as well as the effect it had on their beliefs about the role of experiments and the concept of interaction (interacting bodies) in teaching Newtonian mechanics. The finding of the study corroborates the findings of this study that in-service training impacts highly on teachers.



In the same way, Essien, Akpan and Obot (2016) in their work examined the influence of in-service training, seminar and workshop attendance by social studies teachers on students' academic performance in Cross River State, Nigeria. The result of the analysis revealed that there exist a positive and small relationship between the frequency of teachers' attendance at in-service training, seminars and workshops and students' academic performance in social studies. This implies that teachers who attended the programme were able to impact the knowledge of social studies effectively to the students than those who did not attend the training. In-service training for Mathematics teachers on utilization of technology.

Tables 3 and 4 revealed insignificant results as the mean values of the 6 statements/items when compared with their aggregated mean of 1.6 was less than 2.5 which is the average mean. These indicate that the programme was not impactful in this regard. It can therefore be inferred that, most of the mathematics teachers' have not been positively impacted by the in-service training towards the utilization of modern technology. Many studies are bound to this fact, such as that of Sanchez – Garcia, Marcos, Guanlin and Escribano (2013) who studied teacher development and ICT: The effectiveness of a training programme for in-service school teacher. Although the results indicated that the teachers were highly satisfied with the course syllabus, the learning of teaching strategies and creation of new materials for classroom, the learning of technological skills to manage the suggested programme and technologies was insignificant.

The result of Alkaria and Alhassan (2017) study was on the contrary to the result of the present study. The result disclosed the second semester results to be statistically significant as the result recorded statistically significant differences between the achievement test mean score in favor of the experimental group that was trained using an electronic training platform. This result also revealed a positive effect on attitude toward teaching programming for environmental group.

Although, the findings of Mcdongald (2013) are in contrast with the current study but in accordance with that of Alkaria and Alhasan that, teachers' now have necessary abilities to evaluate ICT tools in accordance with their teaching context beside others due to training. Mtebe, Mbiwilo and Kissaka (2016), also in contrast with the study at hand, commended that other than the performance expectancy, other factors were statistically significant on teachers' acceptance and use of developed content.

Onasanya, Shehu, Ogunsanya and Adefuye (2011) findings was partially in support of the study, Mathematics teachers' in-service training and utilization of modern technology as the result of their analysis, revealed that female teachers' awareness did not influence the utilization of information communication technologies as their male counterparts. However, in the contemporary educational setting that we have today, more and more educator's applause both the pre- service and in- service. They put more efforts in identifying with technological advances by integrating it into their educational system.

For instance, in Greek according to Papadiamantopoulou. Papadiamantopoulon, Armakolas and Gomatoes (2016), the Greek educational system established more conducive conditions for a computer- centered learning in both Primary and Secondary education. But, despite continuous increase of technological resources that teachers can utilize during instructions, limited research exists to date regarding the use of technology by computer – literate teachers, let alone the intervention of the technology used by computer- literate pre- service teachers. Their result showed that pre- service teachers intend to use technology for future professional reasons in a greater degree than in-service teachers actually do, while some aspect of pre- service teachers' technology use are affected by their age and teaching domain.

## Recommendations

Base on the objectives and findings of this study the under listed recommendations were made:

1. The study revealed that the Mathematics teachers' in-service training programme has significantly impacted teachers teaching pedagogy. It was therefore, recommended that the government of Akwa Ibom State should ensure regular support for the in-service training of all Mathematics teachers.
2. It was realized from the study that the training did not significantly impact the teachers' ability to utilize technology. On this regard, the government and agencies should support the Mathematics teachers with provision of technologies that will facilitate the appropriate delivery of Mathematics instruction to learners in public secondary schools and also, put in place the appropriate machineries that will enhance the usability of these technologies.

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