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The Integration of Mathematical Software Competency Quality into Mathematics Teachers' Education in Delta State

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Abstract
The stumpy abilities of Mathematics teachers' in the area of Mathematical Software literacy is one of the influences that cause Mathematics teachers not to improve the use of Mathematical Software as a tool to support teaching and learning of Mathematics in the classroom. This paper discusses Mathematics teachers' quality in Mathematical Software literacy, its population comprised of ninety (90) Mathematics lecturers/teachers who are holders of Bachelor degrees and Master degrees in Mathematics in tertiary institutions in Delta State and a quasi-experimental design. The sample size consists of sixty (60) Mathematics teachers' who were drawn from four (4) tertiary institutions of whom twenty-eight (28) Mathematics teachers' hold Bachelor degrees in Mathematics and thirty two (32) Mathematics teachers' hold Master degree in Mathematics. The simple random sampling technique was used to determine the sample size and the various selected tertiary institutions for the research study. The instrument for data collection was researchers developed questionnaire titled "Mathematical Software Competent Quality of Mathematics Teachers Questionnaires (MSCQMTQ)". The research study was guided by two (2) formulated research questions and two (2) research hypotheses. The research questions were answered by the mean and standard deviation while the t-test Statistics was used to test the research hypotheses at 5% level of significance. The findings revealed that there was a significant difference between Mathematics teachers' in the Experimental cohort and Mathematics teachers' in the Control cohort who hold Bachelor degrees and Master degrees in Mathematics in Mathematical Software Competent Quality. Thus, it was recommended that Mathematics lecturers/teachers in all tertiary institutions should be trained on how to use Mathematical Software for research and building Mathematical Software literacy in the learners.

Keywords: Mathematical Software, Teachers' Quality and New Classroom Technology

Introduction
Mathematics as a subject is interpreted as being abstract, difficult and met only for the gifted Students (Hill and Brain, 2005). These are the ideas that Mathematics learners mediate upon during and after Mathematics discourses. It continues to the level of the Mathematics educators who often iterate that the subject is only met for the gifted in the society.The overall success of Mathematics education irrespective of the nature of Mathematics among Mathematics learners and Educators is the hub of all Mathematics teachers. The Mathematics teachers are the centre of the curriculum both planning and implementation stages (Kaput, 1992) and (Jackson, 2017) which is based on their quality in all levels of Education in Nigeria is very paramount.

The Mathematics teacher's quality is based on teachers' experiences,

teachers' certification and content knowledge in the discipline (Jackson, 2009). It encompassed pedagogical content of the discipline, pedagogical interaction with students and knowledge of teaching methods (Ogunjujigbe, Ayotunde and Adedokun, 2008). A judicious utilization of these qualities in the learning environment of Mathematics by the teachers makes them an effective teachers' of the subject.

There are lots of grieved problems emanating from the teaching of Mathematics in tertiary institutions in Nigeria. And one of such issues is the quality of the Mathematics teachers which had been discovered that most of them are unqualified to teach the subject as they use ineffective teaching methods and lack knowledge of innovative techniques of quality teaching and learning of Mathematics (Agwagah, 2013). Next, is the issue of Mathematical Software (MS), which educational researchers in Mathematics have not been able to tie to Mathematics teachers' quality because digital software in the Science (Mathematics) and Engineering field certainty in our tertiary institutions will help to erode the abstract and difficult nature of the subject from the learners' perceptions.

This Mathematical Software quality is necessary now because Mathematics learners are always inquisitive about the areas of Mathematics applications and the aftermath of the subject in the society (Jacome, 2016). Mathematics teachers' need to be abreast with this Mathematical Software which they can use during the subject discourse and transmit the skills to the students in the various unique areas of Mathematics (Weiss and Joan, 2006). In recent times, the Mathematical Software are termed instructional technology because they are recognized as a powerful means to boost students' achievement in Mathematics (Valdez, 2010) and (Mati and Haruna, 2020).

Also, National Council of Teachers of Mathematics (NCTM, 2000) propounded that technology in digital Software form can help teach Mathematics contents and enabling them to observe and create multiple representation of Mathematical ideas numerically, graphically and symbolically. The overall success of Software thriving in the learning environment in a Mathematics classroom rest on the Mathematics teachers. This further implies that, if a Mathematics teacher lacks the knowledge of Mathematical Software, then the problem of abstractness of the subject will surface (Bimgimlas, 2009) and (Suparman, Untoro, Prabowo & Andriyani, 2019).

Therefore, to create a meaningful impact in Mathematics education, Mathematics course should be link to Mathematical Softwares. This has prompted a global emphasis on all levels of education that schools have to work to improve Mathematics students learning achievement by investing heavily in new classroom technology (Otuka, 2002) and (Joshi, 2017). This new classroom technology is driven by Mathematical Software. It is the Mathematics teachers' jurisdiction to dispense its content and application in Mathematics. Hence, it is necessary to investigate Mathematics teachers' quality and their Mathematical Software Competence quality.

Statement of Problem

The quality of Mathematics teachers in Nigeria tertiary institutions is very paramount. These qualities had been based on teachers experience, teachers' certifications and their content knowledge in Mathematics. To achieve an outstanding performance in Mathematics achievement, Mathematics teachers' quality with reference to Mathematics software literacy should be ascertain among Mathematics teachers. Thus, the following were posed and answered in this research study:

1. Would there be any Mathematics Software quality competence difference among Mathematics Teachers who are Bachelor degree holders in Mathematics?
2. Would there be any Mathematics Software quality competence difference among Mathematics teachers who are Master degree holders in Mathematics?

Research Questions:

The following Research Questions were formulated to guide the research study:

1. What is the Mean Competence difference in Mathematics Software quality literacy between Mathematics Teachers in the Experimental Cohort and Control Cohort who are Bachelor degree holders in Mathematics?
2. What is the Mean Competence difference in Mathematics Software quality literacy between Mathematics Teachers in the Experimental cohort and Control Cohort who are Master degree holders in Mathematics?

Research Hypotheses:

The researchers developed the following Research Hypotheses for the study:

H_{O1}: There is no significant difference between the Mean Competence in Mathematics Software Quality literacy between Mathematics Teachers' in the Experimental Cohort and Control Cohort who are Bachelor degree holders in Mathematics.

H_{O2}: There is no significant difference between the Mean Competence in Mathematics Software Quality literacy between Mathematics Teachers' in the Experimental Cohort and Control Cohort who are Master degree holders in Mathematics.

Research Methodology

Design

The research study adopts a quasi-experimental design. It is a study that includes a manipulated independent variable like a random assignment. It involves a pretest-posttest design (William, 2006).

Population

The population of the research study consists of all Mathematics teachers in higher institutions that are in Mathematics department who are full time lecturers at the University and College of Education level.

Sample and Sampling Techniques

The sample size of this research study consists of Sixty (60) Mathematics teachers with twenty-eight (28) and thirty-two (32) as Bachelor and Master Degree holders in Mathematics respectively. They were selected through the simple random sampling techniques among all Mathematics teachers. The selection

process involves marking ballot papers "participant" and "non participants" that were distributed in four (4) selected tertiary institutions in Delta state.

Research Instrument

The instrument used for this research study was researcher's developed questionnaire titled "Mathematical Software Competence Quality of Mathematics Teachers Questionnaires (**MSCQMTQ**)". It comprises of two (2) sections: section A and section B. The section A sought for the Mathematics demographic information while section B consists of the twenty (20) items questionnaires.

Research Instrument Validation

The research instrument was exposed to both content and face validation by experts from College of Education, Warri who were from Computer Science department. The instrument was also pilot tested on separate categories of Mathematics teachers. The test results yielded a reliability coefficient of 0.79 Spearman rank correlation coefficient formula. This was reasonably high enough to judge that the instrument was reliable.

Experimental Procedures

The research study consists of two (2) main stages with two (2) Cohorts: Experimental cohort and Control cohort for both the Bachelor degree holders and Master degree holders. The first stage was the pre-**MSCQMTQ** of both the Experimental (treatment) cohort and control cohort. The second stage was the treatment of the experimental cohort using the Mathematical software which involves training and practical workshop on the subjects. At the end of the treatment period, the post-**MSCQMTQ** for the two (2) cohorts was recorded after the administration of the **MSCQMTQ** through the assistance of three (3) experts in computer science department on all the respondents. Theexperts who specialized in Mathematical Software also help in the training process of the treatment (experimental) cohorts. The training process of the respondents lasted for a period of four (4) weeks. And at the end of the **MSCQMTQ** administration, data collected were recorded to form the basis for data analysis for the two cohorts on which the mean, standard deviation and the t test statistics values were calculated. The mean and standard deviation were used to answer the stated research questions while the t-test statistics was used to test the research hypotheses at 5% level of significance.

Research Results

Research Questions One

What is the Mean Competence difference in Mathematics Software Quality between Mathematics Teachers in the Experimental Cohort and Control Cohort who are Bachelor degree holders in Mathematics?

Table1: Descriptive Analysis of Pre and Post MSCQMTQ scores of Bachelor degree Teachers'

S/N	.Maths. Software. Competent Quality	N	Pre MSCQMTQ Scores		Post MSCQMTQ Scores		Diff. in Pre & Post MSCQMTQ Scores	
			X	SD	X	SD		
1.	EXPERIMENTAL COHORT	14	2.87	0.78	4.12	1.10	1.25	
1.	CONTROL COHORT	14	3.02	0.81	3.46	0.92	0.44	

The result from table1 indicates that the experimental cohort had a mean competence and a standard deviation of 2.87 and 0.78 respectively, while the control cohort had a mean competence and a standard deviation of 3.02 and 0.81 respectively in the pre-MSCQMTQ. Also, in the post-MSCQMTQ the mean competence and standard deviation of the experimental cohort is 4.12 and 1.10 respectively and the control cohort mean competence and standard deviation is 3.46 and 0.92 respectively. The result revealed that the Mathematics teachers' with Bachelor degrees in Mathematics who are in the experimental cohort had a better mean competence in their statistical scores than the Mathematics teachers' withBachelor degree in Mathematics in the control cohort as shown by their higher difference in the mean competence scores.

Research Question Two:

What is the Mean Competence difference in Mathematics Software Quality between Mathematics Teachers in the Experimental Cohort and Control Cohort who are Master degree holders in Mathematics?

Table2: Descriptive Analysis of Pre and Post MSCQMTQ scores of Bachelor degree Teachers'

S/N.	Maths. Software Competent Quality	N	Pre MSCQMTQ Scores		Post MSCQMTQ Scores		Diff. in Pre &Post MSCQMTQ Scores	
			X	SD	X	SD		
1.	EXPERIMENTAL COHORT	16	3.16	0.97	5.29	1.32	2.13	
2.	CONTROL COHORT	16	2.51	0.63	3.84	0.96	1.33	

The result from table 2 indicates that the experimental cohort had a mean competence and a standard deviation of 3.16 and 0.97 respectively, while the

control cohort had a mean competence and a standard deviation of 2.51 and 0.63 respectively in the pre-MSCQMTQ. Also, in the post-MSCQMTQ the mean competence and standard deviation of the experimental cohort is 5.29 and 1.32 respectively and the control cohort mean competence and standard deviation is 3.84 and 0.96 respectively. The result revealed that the Mathematics teachers' with Master degrees in Mathematics who are in the experimental cohort had a better mean competence in their statistical scores than the Mathematics teachers' with Master degrees in Mathematics in the control cohort as shown by their higher difference in the mean competence scores.

Testing the Research Hypotheses

Research Hypothesis One

There is no significant difference between the Mean Competence in Mathematics Software Quality between Mathematics Teachers' in the Experimental Cohort and Control Cohort who are Bachelor degree holders in Mathematics.

S/N.	Maths. Software Competent. Quality.	N	Grand Mean	Grand SD	df	t-Calculated Value	t-Critical Value	Remark
1.	EXPERIMENTAL COHORT	144	121.10					
					26	**5.45**	**2.056**	**Significant**
2.	CONTROL COHORT	143	460.92					

Table 3 revealed the result of the t-test analysis and the t-critical value at 5% level of significance. The t-calculated value is 5.45 while the t-critical value is 2.056. Thus, we reject the null hypothesis since the t-cal. value is greater than the t-crit. value. The result infers that Mathematics teachers' with Bachelor degrees in Mathematics in the experimental cohort have a significant relationship in Mathematical Software than Mathematics teachers' with Bachelor degrees in Mathematics in the control cohort.

Research Hypothesis Two:

There is no significant difference between the Mean Competence in Mathematics Software Quality between Mathematics Teachers' in the Experimental Cohort and Control Cohort who are Master Degree Holders in Mathematics.

S/N.	Maths. Software Competent Quality.	N	Mean	SD	Grand Mean	Grand SD	df	t-Calculated Value	t-Critical Value	Remark
1.	EXPERIMENTAL COHORT	16	5.29	1.32						
							30	3.55	2.042	Significant
2.	CONTROL COHORT	16	3.84	0.96						

Table 4 revealed the result of the t-test analysis and the t-critical value at 5% level of significance. The t-calculated value is 3.55 while the t-critical value is 2.042. Thus, we reject the null hypothesis since the t-cal. value is greater than the t-crit. value. The result infers that Mathematics teachers' with Master degrees in Mathematics in the experimental cohort have a significant relationship in Mathematical Software than Mathematics teachers' with Master degrees in Mathematics in the control cohort.

Discussions

The result from tables 1 and 2 show that the difference between the mean competence in Mathematics teachers' in the experimental cohort and control cohort as follows: *2.87 & 3.02; 4.12 & 3.46: 3.16 & 2.51; 5.29 & 3.84* respectively in the pre and post **MSCQMTQ** scores. These differences were in favour of the Mathematics teachers' in the experimental cohort. Thus, this difference in mean competence of Mathematics teachers' in Mathematics Software Quality of the experimental cohort is due to the treatment given to them on Mathematics Software. This quality will help improve the performance of the Mathematics teachers in this contemporary era where learning in the classroom is revolving into digital form. This result supports the earlier study of Sanders June (2009) who found that the residual effects of Mathematics teachers' is tested when they are able to cope and meet the ever challenging situations in the classroom especially when technology is almost taking over every sphere of the mathematics discourse. Also, Table 3 and 4 showed the t-test Statistic analysis results that there was a significant difference between Mathematics teachers' in the experimental cohort and control cohort in Mathematics Software Quality competence of both the Bachelor degree holders and Master degree holders. This showed that Mathematics teachers in the Experimental cohort have Mathematical Software Quality to their content/ knowledge quality in Mathematics. Thus, this will make them better and competent in a functional Mathematical digital environment.

Conclusion

The research study has shown that the integration of Mathematical Software into Mathematics teachers' quality is a fundamental stride now so that

Mathematics teachers' can be abreast on the need and horizon that education generally is developing into. This integration had led to Mathematical Software competence of those Mathematics teachers in various tertiary institutions. And this will in turn create a curiosity in the Mathematics teachers' to pass the Mathematical Software quality to the incoming Mathematics teachers who are still in the learning environment.

Recommendations:

Based on the findings from the research study, the researchers recommend as follows:

1. Mathematics lecturers/teachers in all tertiary institutions should be trained on how to use Mathematical Software for research and building Mathematics Software competence in the learners.
2. The Federal and State government should disbursed laptop computers to all Mathematics lectures/teachers with fully installed mathematics software programmes.
3. The government at all level should employ quality software programmers in the Mathematics department of all institutions who will help in turn train Mathematics students and the incompetent Mathematics lecturers/teachers.

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