



INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT

AN ANALYSIS OF THE RELATIONSHIP BETWEEN TEACHERS' SELF EFFICACY, INSTRUCTIONAL MATERIALS AND STUDENTS' ACHIEVEMENT IN SECONDARY SCHOOL MATHEMATICS IN LAGOS STATE

DR.(MRS.) O. M. ALADE, DR. S. ALETAN and SOKENU

B.S. of Department Of Educational Foundations University Of Lagos, Nigeria

DOI: 10.5281/zenodo.1252171

Keywords: Mathematics; Mathematics teaching; self-efficacy; Instrumental materials.

Abstract

This study examined the relationship between Teachers' mathematics teaching self-efficacy, Use of mathematics instructional materials and Students' achievement in secondary school mathematics. Descriptive survey of the correlation type was adopted for this study. Simple random sampling technique was used to select three Educational Districts out of the six Educational Districts in Lagos State, while stratified random sampling technique was used to select 40 schools from each of the selected Educational Districts. Six SSII students and their mathematics teacher were selected from each of the 40 schools, making a total of 120 teachers and 720 students who were used as the participants of this study. The three valid and reliable instruments used to collect data were the; Mathematics teaching Self-efficacy Scale (MTSES), Questionnaire on utilization of mathematics instructional materials (QUMIM) and Mathematics achievement test (MAT). Their test retest reliability values were 0.82, 0.87 and 0.84 respectively using Kuder-Richardson (KR-20)'s formula. The result of the Pearson correlation and Multiple regression analyses show that: There is a significant positive relationship between the teachers' mathematics teaching self-efficacy and utilization of mathematics instructional materials; there is a significant positive relationship between the teachers' utilization of mathematics instructional materials and students' achievement in mathematics; there is a significant relationship between teachers' mathematics teaching self-efficacy and students' achievement in mathematics; the two predictor variables jointly accounted for 45.2% variations in students' academic achievement in mathematics. It is recommended that, Government and school heads should make mathematics instructional materials available in secondary schools; Self-efficacy enhancement programme should be organized for the mathematics teachers to enable them develop self confidence in their ability to effectively impact knowledge in their students.

Background of the study

Mathematics is a compulsory subject at the secondary school level irrespective of students' learning ability. Its pervades literally every field of human endeavor and plays a fundamental role in the economic development of a country. Oyegoke, (2014) emphasized that mathematics is needed by individuals in the society for the execution of their day to day activities and helps people to think, act logically, analytically and critically.

Quality teaching is multi-faceted, it includes not only individuals' knowledge, but also individuals' sense of efficacy, their belief in their own ability as teachers to organize and execute their teaching to help students learn (Bandura, 2006; Henson, 2002).

Ormrod (2006) refers to self-efficacy as the belief that one is capable of performing tasks in certain ways to attain certain goals. Askar and Davenport (2009) submit that self-efficacy has emerged as an important means of understanding and predicting a person's performance. Jegede (2007), opines that higher level of self-efficacy corresponds to greater achievement while According to Bandura (1990), the stronger the perceived self-efficacy, the more likely teachers are to adopt the recommended practice.

Mathematics self-efficacy is a person's belief in his ability to successfully perform well in mathematics (Burnham, 2011). Tschannen-Moran and Hoy (2001), defines mathematics teacher's self-efficacy as teacher's capability to organize and execute courses of action during classroom Mathematics instruction to accomplish specific teaching tasks within a particular context.



INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT

Instructional materials are all the tools which are needed by the teacher to provide help and encouragement to students' learning activities (Ema and Ajayi, 2004). In the words of Onyejemezi in Eya and Ureme (2011), Instructional materials are resources or teaching materials, which a teacher utilizes in the course of presenting a lesson in order to make the content of the lesson understandable to the learners. The implication is that the use of instructional materials is inevitable if effective teaching and learning must be achieved. Eya (2004), opines that instructional materials stimulate teachers' interest, help both the teacher and learners to overcome physical limitation in the system of the teaching and learning process.

A report by Ojerinde (2000) on the survey of the performance of candidates in Mathematics in Nigeria over the years revealed a discernible decline. This perennial decline has remained a source of concern to science educators, Mathematicians and Mathematics educators (Nnaka & Anaaekwe, 2004). For example, in the Senior School Certificate Mathematics Examinations conducted by the West Africa Examinations Council, 2006-2015, students' achievement in Mathematics was below 50% credit pass for each year except in 2011 and 2015 which were slightly above average. Table 1 illustrates the magnitude of the problem.

Table 1: Statistics of Entry and Performance in Mathematics from 2006-2015 May/June WASSCE in Nigeria.

Year	Total Entry	Total Sat	%	Total Absent	%	Total Credit 1-6	Total in %
2006	1038809	1024451	98.61	14358	1.38	377312	36.83
2007	1035266	1019524	98.47	15742	1.52	346410	33.97
2008	1080133	1054853	97.65	25280	2.34	402982	38.20
2009	1170523	1149277	98.18	21246	1.81	472674	41.12
2010	1270136	1249028	98.33	21108	1.66	584024	46.75
2011	1292890	1268213	98.09	24677	1.90	726398	57.27
2012	1373009	1348528	98.22	24481	1.78	634382	47.04
2013	1331374	1306535	98.13	24839	1.87	548065	41.95
2014	1540141	1508965	97.98	31176	2.02	608866	40.35
2015	1695878	1658579	97.79	37521	2.21	838879	50.58

Source: West African Examinations Council (2015).

This paper focused on the relationship between teachers' teaching self-efficacy, utilization of Mathematics instructional materials and students' achievement in secondary school Mathematics in Lagos State.

1. Statement of the problem

A critical analysis of candidates' results in Mathematics in the various senior secondary certificate examinations in Nigeria also buttresses the below average performance of students over the years. The trend of students' performance in Mathematics from 2006 to 2015 in the West African Senior Secondary Certificate Examination (WASSCE) affirms this assertion (See Table 1). Literature reveals that several factors that determine students' achievement, among which are; school quality, teacher quality, teaching methodology, school environment, etc. Several efforts have been put in place by different stake holders to solve this problem, yet there is still high rate of failure in the school certificate of Mathematics. Nevertheless, an aspect which research in Mathematics Education has not focused on much is how Mathematics teaching self-efficacy and utilization of Mathematics instructional materials together affect students' performance in Mathematics.

Therefore, this study intends to investigate the relationship between teachers' Mathematics teaching self-efficacy, use of Mathematics instructional materials and students' achievement in Senior Secondary school Mathematics in Lagos State.

2. Theoretical framework

The theoretical framework for this research study was based on the theories of self-efficacy and constructivism.



INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT

Self-efficacy

The theory of self-efficacy was developed by Albert Bandura in 1977, as part of a larger theory, the social learning theory (SLT) which was later developed into the social cognitive theory (SCT) in 1986. Bandura defined self-efficacy as “people’s beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives”. The theory was based on the assumption that “psychological procedures, whatever their forms, serve as a means of creating and strengthening expectations of personal efficacy”.

Constructivism

The theory of constructivism was developed by Jerome Bruner in 1966. A theme in the theoretical framework of Bruner is that learning is an active process in which learners construct new ideas or concepts based upon their current or past knowledge. The learner selects and transforms information, constructs hypotheses, and makes decisions, relying on a cognitive structure to do so. Cognitive structure (i.e, schema, mental models) provides meaning and organization to experiences and allows the individual to “go beyond the information given”.

3. Purpose of the study

The main purpose of the study is to find out the relationship between teachers’ Mathematics teaching self-efficacy, utilization of instructional materials and students academic achievement in Senior Secondary School Mathematics. The Specific purposes are:

- To find the relationship between teachers’ Mathematics teaching self-efficacy and the utilization of Mathematics instructional materials.
- To find the relationship between the use of Mathematics instructional materials and students’ achievement in Mathematics.
- To find the relationship between teachers’ Mathematics teaching self-efficacy and students’ achievement in Mathematics.
- To find out if there is any interaction effect of the combination of teacher’s Mathematics teaching self-efficacy and use of instructional materials on the academic performance of Senior Secondary School students in mathematics.

4. Research question

- Is there any significant relationship between teachers’ Mathematics teaching self-efficacy and the utilization of Mathematics instructional materials?
- Is there any significant relationship between the use of Mathematics instructional materials and students’ achievement in Mathematics?
- Which type of relationship exists between teachers’ Mathematics teaching self-efficacy and students’ achievement in Mathematics?
- Is there any interaction effect of the combination of teachers’ Mathematics teaching self-efficacy and utilization of mathematics instructional materials on students’ achievement in Mathematics?

5. Research hypotheses

- There is no significant relationship between teachers’ Mathematics teaching self-efficacy and utilization of Mathematics instructional materials.
- There is no significant relationship between utilization of Mathematics instructional materials and Senior Secondary School Students’ achievement in Mathematics.
- There is no significant relationship between teachers’ Mathematics teaching self-efficacy and academic achievement of Senior Secondary School Students in Mathematics.
- There is no significant interaction effect of the predictor variables (teachers’ Mathematics teaching self-efficacy and utilization of Mathematics instructional materials) on Senior Secondary School Students’ achievement in Mathematics.



INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT

6. Significance of the study

This study will provide insights to the curriculum developers, teachers, parents, students, counselors and policy makers regarding the relationship between the teachers' mathematics teaching self-efficacy, utilization of instructional materials and students' academic achievement in mathematics. The findings of the study will enable teachers to assist their students to understand mathematical concepts, through the use of mathematics instructional materials. It will also sensitize the teachers on the need to develop high self-efficacy towards the teaching of mathematics and it will be of great benefit to the students because it will enhance and improve general performance of students most especially in mathematics.

Literatures review

Literatures were reviewed under the following headings;

1. Concepts of education

The National Policy on Education (2013) stated that education will continue to be highly rated in the National Development plans, in that education is the most important instrument of change, as any fundamental change, as any fundamental change in the intellectual and social outlook of any society has to be preceded by an educational revolution. The country today is facing many problems in the course of providing education for their citizen. The problems are closely related to planning, implementation and research activities. Solutions to these problems could be found in the application of educational technology and the applicability of mathematical knowledge.

2. Teachers' mathematics teaching self-efficacy

Henson (2001) opined that teachers with high mathematics teaching self-efficacy are always ready to accept new ideas, exhibit willingness to embrace innovations. Brouwers & Tomic (2003) buttress that such teachers are less likely to experience stress, believe in the freedom of students to a greater extent. Ulu and Ertekin (2013) conducted a study on the relationship between mathematics teaching self-efficacy and mathematics self-efficacy of 144 mathematics teachers. The study indicated high performance on both scales by the participants, and also there was significant positive relationship between mathematics teaching self-efficacy and mathematics self-efficacy of the teachers.

3. Impact of instructional materials on teachers' performance

Abdullahi, (2008) stated that instructional materials help teachers to make use of the working model. Chima (2009) argued that instructional material help the teacher to have better understanding with his students. In this case, students would be very proud of their teacher and goes to the teacher even after teaching to obtain from the teacher the area they failed to understand in their previous class. Olawale (2010), said instructional materials improves teachers creativeness. As the teacher studies according to instruction he assimilates easily what knowledge to impact to students.

4. Impact of instructional materials on students' learning

Adeluku, (2012) investigated the influence of instruction materials in teaching and learning of mathematics in senior secondary schools in Cross River State. The study revealed that students taught with instructional materials performed significantly better than those taught without instructional materials and also that the use of instructional materials generally improved students understanding of concepts and led to high academic achievement. Maruff and Amos (2011) examined the effect of using standardized and improvised instructional materials on academic achievement of secondary school mathematics student in Oyo State, Nigeria. The findings revealed that there was a significant difference in the achievement of students taught using standard instructional materials than those in the conventional instruction. The researcher concluded that the utilization of improvised instructional materials promote and enhance effective teaching-learning process, thus mathematics teachers should be encouraged to use them in their lessons.

5. Mathematics instructional materials that are relevant at the secondary school level.

Mathematics instructional materials can be defined as those things used by the teacher to assist, support and facilitate teaching and learning of mathematical concepts some of these mathematics instructional materials are;



INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT

Abacus and games, Charts, Still pictures, Real objects, Solid shapes, Globes, Counting board, Geo-board, Mathematics room, Punch cards and paper tapes, Clinometers, Sets of mathematical instruments, Portable graph-board, Mathematics text books etc.

Methodology

1. Research Design

This research employed a survey design. This is because the independent variables to be investigated had already occurred and cannot be further subjected to manipulation.

2. Population

The population of this study comprised all the senior secondary school two students in Lagos state and the mathematics teachers.

3. Sample/Sampling Procedure

The sample for this study was made up of 720 students and 120 mathematics teachers (both males and females). In selection of the students, simple random sampling technique was used to select three Educational Districts out of the six in Lagos state, while stratified random sampling was used to select forty schools from each of the three Educational Districts selected. Six SSII students and their Mathematics teacher from each of the sampled schools participated in the study to avoid disorganizing the school. SSII students were selected for the study because they are not in the mood of the school certificate Examination and they have covered majority of the senior secondary school curriculum.

4. Instrumentation

Three instruments were used to gather data for this study. They were; Mathematics teaching self-efficacy scale (MTSES) developed by Diana K. May (2009). This instrument was adapted (by modifying some of the items in scale) and revalidated. Its reliability coefficient was found to be 0.82. The Questionnaire on Utilization of Mathematics Instructional Materials (QUMIM) and Mathematics Achievement test (MAT) were both developed and validated by the researchers. The content validity of the QUMIM was established through the input of some experts in the field of Measurements and Evaluation. Its validity and reliability was established using the Cronbach Alpha method and its reliability coefficient was found to be 0.86. The internal consistency of the MAT was established through Kuder-Richardson 20(KR-20), it was found to be 0.84.

5. Procedure for Data collection

The researchers met with the principals of the selected schools to inform them about the purpose of this study and to solicit their support by allowing their students to participate in the research. The MAT was then administered to the students and collected back after one hour (which was the time allowed for the test). After this, the MTSES and QUMIM were administered to the teachers. The teachers were given enough time to express their honest feelings without any bias. The scales were retrieved from the teachers and graded. The average of the scores of the sampled students in each school was found and used for the analysis.

6. Data Analyses

Data generated from various instruments were analyzed statistically using both descriptive and inferential statistics. Descriptive statistics was used to show the means, minimum scores, maximal scores and standard deviations while the hypotheses were tested with the use of Pearson product moment correlation coefficient and Regression analysis at 0.05 level of significance.

**Result and Discussion****1. Presentation of Data****Table 2: Descriptive statistics of Teachers' mathematics teaching self-efficacy (TMTSE), utilization of mathematics instructional materials (UMIM) and Mathematics Achievement Test (MAT)**

Variables	Mean	Median	Mode	STD.	Min.	Max.	N
MTSES	69.94	68.50	68.00	10.86	46.00	92.00	120
UMIM	58.54	58.00	48.00	10.13	40.00	85.00	120
MAT	57.10	56.00	55.00	9.55	32.00	78.00	120

The data in table 2 showed the summary of the data collected from the three instruments used in this study. The table reveals that the mean, median and the mode score of MTSES are 69.94, 68.50 and 68.00 respectively. The standard deviation is 10.86, the minimum score is 46.0 and the maximum score is 92.00. The mean, median and mode scores for UMIM are respectively 58.54, 58.00 and 48.00. The standard deviation is 10.13 and the minimum score is 40.00, while the maximum score is 85.00. The mean, median, mode, the standard deviation, the minimum and the maximum scores in MAT are respectively 57.10, 56.00, 55.00, 9.55, 32.00 and 78.00. The table further reveals that the scores of the teachers in MTSES, UMIM and the scores of the students in MAT are negatively skewed.

2. Data Analysis

The data collected were analyzed to provide answers to the research questions and also to test the hypotheses raised.

Hypothesis one

There is no significant relationship between the teachers' mathematics teaching self-efficacy and utilization of mathematics instructional materials.

Table 3: The relationship between Teachers' mathematics teaching self-efficacy and the utilization of mathematics instructional materials

Variable	N	mean	SD	df	r _{cal}	sig.
TMTSE	120	69.94	10.86	118	0.45	0.000
UMIM	120	58.54	10.13			

As shown in table 3, the computed r – value of 0.45 was found significant at $\alpha = 0.05$ and with degree of freedom of 118. This implies that there is a significant positive relationship between teachers' Mathematics teaching self efficacy and utilization of Mathematics instructional materials. This is in agreement with the findings of chima (2009) and Olawale (2010), who reported that instructional materials improves teachers' creativeness and it help teachers to have better understanding with their students.

Hypothesis Two

There is no significant relationship between the use of mathematics instructional materials and student's achievement in mathematics.



INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT

Table 4: The relationship between the utilization of mathematics instructional materials (UMIM) and students' mathematics achievement (MAT)

Variable	N	Mean	SD	df	r _{cal}	Sig.
UMIM	120	58.54	10.13	118	0.18	0.048
MAT	120	57.10	55.00			

As revealed in table 4, the result of the data analyzed showed that the calculated r-value of 0.18 is significant at degree of freedom of 118 and at 0.05 level of significance. Hence there is a significant relationship between the utilization of mathematics instructional materials and the students' achievement in mathematics. This support the finding of Adeluku (2012), who reported that student taught with instructional materials performed significantly better than those taught without instructional materials and also that the used of instructional materials generally improved students understanding of concepts and led to high academic achievement.

Hypothesis Three

There is no significant relationship between teachers' mathematics teaching self-efficacy and student' academic achievement in mathematics.

Table 5: The relationship between teachers' mathematics teaching self-efficacy(MTSES) and students' academic achievement in mathematics (MAT)

Variable	N	Mean	SD	df	r _{cal}	Sig
MTSES	120	69.94	10.86	118	0.35	0.000
MAT	120	57.10	9.55			

In table 5, it is observed that a positive and significant relationship exist between mathematics teaching self-efficacy and the students' mathematics achievement. ($r_{cal} = 0.35$, $p < 0.05$). Thus there is a significant relationship between the teachers' mathematics teaching self-efficacy and the students' mathematics achievement. This finding support the report of Adeleke (2013) and Peter (2015), in their research works, they both discovered that, mathematics teaching self-efficacy of teachers have significant relationship with students' achievement in mathematics.

Hypothesis Four

There is no significant interaction effect of the predictor variables (teachers' mathematics teaching self-efficacy and utilization of mathematics instructional materials) on students' achievement in mathematics.

Table 6: Summary of Regression Analysis of the predictors' variables (MTSE and UMIM) on students' achievement in mathematics

Model	R	R ²	Adjusted R ²	Standard Error
	0.547	0.452	0.401	9.03

Table 6 revealed that the multiple regression coefficient (R) showing the linear relationship between the predictor variables and students' achievement in mathematics is 0.547. The adjusted R-Square value is 0.452. This implies that the variation in students' academic achievement in mathematics jointly accounted for by the predictor variables is 45.2%. The findings revealed also that the independent variables combined together are good predictors of academic achievement in mathematics.



Table 7: Summary of Analysis of variables

Model	Sum of squares	df	Mean squares	F	sig.
Regression	1301.85	2	650.93	7.98	0.000
Residual	9540.95	117	81.56		
Total	10842.80	119			

An analysis of variance (ANOVA) Table 7 was used to further test the significance of the linear relationship between the dependent variable and the independent variables. The table shows that the calculated F ratio is 7.98 at 0.05 level of significance and (2,117) degree of freedom. Therefore there is a significant interaction effect of the predictors' variables on the students' academic achievement in mathematics. This claim was supported by Eya (2004), who reported that instructional materials stimulate teacher's interest, and consequently, it improves students' academic performance.

Summary of the Findings

- The findings of the study are that;
- There is a significant positive relationship between teachers' mathematics teaching self-efficacy and utilization of mathematics instructional materials ($r=0.45$, $\alpha=0.05$).
- There is a positive significant relationship between utilization of mathematics Instructional materials and students' achievement in mathematics ($r=0.18$, $\alpha=0.05$).
- There is a positive relationship between teachers' mathematics teaching self- efficacy and students' achievement in mathematics ($r=0.35$, $\alpha=0.05$)
- The predictor variables (Teachers' mathematics teaching self efficacy and utilization of mathematics instructional materials) jointly accounted for 45.2% variations in students' achievement in mathematics.
- The predictor variables combined together are good predictors of academic achievement in mathematics.

1. Educational Implications

The findings of this study have a lot of implications for all stakeholders in education (curriculum developers, teachers, parents, students, counselors, policy makers and school administrators). The fact that there is a strong, positive and significant relationship between the predictor variables and students' achievement in mathematics, then the use of mathematics instructional materials will help the mathematics teachers to present their lessons effectively before their students. It will also help the teachers to hold students attention in the class, in the end, it will help to improves students' attitude, skill and achievement in mathematics. Therefore the school management and academic staff should take into account the important role of these predictor variables in enhancing the students' achievement in mathematics.

2. Recommendations

On the basis of the findings of this study, the following recommendations are made.

- The government and school heads should make mathematics instructional materials available in secondary schools.
- Mathematic teachers should be made to understand and accept the fact that their Students can perform excellently well in mathematics if the teachers the subject with instructional materials. Self-efficacy enhancement programme should be organized for the mathematics teachers to enable them develop self confidence in their ability to effectively impact knowledge in their students.
- Educational planners and administrators should organize workshops, seminars and conferences that will bring mathematics teachers together to enable them interact freely and



INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT

share ideas with one another and among themselves which will thereby enable the teachers to develop the ability to effectively organize and implement the teaching-learning process to bring about improved performances in students' academic.

- Training institutions such as university faculties of education and colleges of education should insist on ensuring that their students' learn courses in educational technology, where they will learn how to improvise and use many of the instructional materials in teaching and learning mathematics

References

- [1] Abubakar, R. B., & Eze, F. B. (2010). Female students' academic performance in mathematics At Federal college of Education (Technical), Omoku, River state. *International Journal of social and policy issues* 6(1&2), 48-53.
- [2] Akinsola, M. J., Tella, A. (2007). Correlates of academic procrastination an Mathematics achievement of University undergraduate students. *Journal of Mathematics, science and Technical Education* 3(4), 363-370.
- [3] Bandura, A. (2001). *Guide for constructing self-efficacy scales. (Revised)*. Available from Frank Pajares, Emory University, Atlanta. GA, 30322.
- [4] Gbore, L.O. (2013), "Relative contributions of selected Teachers' variables and students' attitude toward academic achievement in Biology among senior secondary school students in Ondo State, Nigeria" *Mediterranean journal of social sciences* 4(1) 25-30.
- [5] Odedele, A.R. (2000), Test anxiety and self-efficacy as correlates of academic performance among secondary school students. *Education and information studies Abstracts, University of Ibadan, (1)* 95-96.
- [6] Olayemi, O. O.(2009). Students' correlates and achievement as predictors of performance in physical chemistry. *ABACUS: The Journal of Mathematics Association of Nigeria* 34(1), 99-105.
- [7] Murat, P. (2016). Mathematics teaching anxiety and self-efficacy beliefs toward mathematics teaching: A path analysis. *Academic Journals*. 11(3), 97-104.
- [8] Habila, E. Z., Simon, K., K., & Bala, G. A. (2016). Pre-service Teachers' mathematics Self-efficacy and Mathematics Teaching Self-efficacy. *Journal of Education and Practice*. 7(14), 93-98.