

TEACHER VARIABLES AS DETERMINANTS OF STUDENTS' ACADEMIC ACHIEVEMENT IN SENIOR SECONDARY SCHOOL MATHEMATICS IN OGUN STATE, NIGERIA

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Abstract

Mathematics as a core subject in secondary school has not been having a good number of students performing well in it. Yet a credit pass in the subject is one of the criteria for admission into some faculties at higher institutions. If the factors affecting good performance of the subject are not well identified and treated; the situation will remain the same. Thus, the study investigated teacher variables as determinants of students' academic achievement in mathematics in Ogun State, Nigeria. The study adopted descriptive survey research design and multi-stage sampling technique was used to select 30 teachers and 300 students from three local government areas. Two research questions were answered and three research instruments namely; Perceived Teacher's Competence Questionnaire; ($r = 0.81$); Perceived Teacher's Efficiency Questionnaire; ($r = 0.89$) and Mathematics Achievement Test, ($r = 0.74$) were used. Data were analyzed using multiple regression analysis. The findings of the study revealed that teacher's competence, experience and efficiency accounted significantly to students' academic achievement in mathematics ($R^2 = 0.55$, $F = 7.895$, $p = 0.05$). Teacher's competence being the best predictor of students' academic achievement in mathematics with ($Beta = 0.537$) was followed by teacher's experience ($Beta = 0.423$), teacher's efficiency ($Beta = 0.308$) while teacher's age ($Beta = -0.064$) which was not significant ($p < 0.05$) was the least predictor. Also, the positive values for teacher's competence, efficiency and experience show that the three variables have positive effect on mathematics achievement while the negative beta value for teachers' age on the other hand revealed negative relationship between teachers' age and students' academic achievement in mathematics. This implies that for students to perform well in mathematics, teachers should be versatile in the subject's knowledge. It could be recommended that constant and continuous workshops and seminars are to be organized for teachers by the government to enhance their productivity.

Keywords: Teachers Competence, Teachers Efficiency, Teacher Experience, Academic Achievement in Mathematics

Background to the Study

The importance accorded mathematics in the school curriculum is the recognition of the indispensable role it plays in contemporary society. Despite the importance accorded mathematics in the school curriculum and the society, it was discovered that the academic achievement of students in the subject across the country was not encouraging. In a study, Obemeata (1992) examines the Senior School Certificate Examinations (SSCE) results for three consecutive years, 1988, 1989 and 1990 in nine subjects including mathematics, and finds that the percentage of students who passed at credit level in all the selected subjects was as low as between 3% and 6% in some of the subjects. Also, in another related study, Adeleke (2007) compared the level of performance of Nigerian students in mathematics

with four other countries (Gambia, Ghana, Liberia and Sierra Leone) exploring Senior Secondary School Certificate Examination conducted by West Africa Examination Council (WAEC) between 1991 and 1999. He notes that Nigeria has the lowest percentage of students that scored between A1 and C6 (13.7%) in an average of a nine year period while others scored 37.6%, 30.1%, 17.8% and 17.0% respectively.

The poor results in this subject have continued to be stumbling-blocks in the realisation of the educational and employment desire of many candidates. As a result, several attempts have been made by researchers to identify factors associated with students' academic achievement in the subject (Ehinder, 2000; Odogwu, 1994; Alele-Williams,

1998; Abimbade, 1997; Akinsola, 1994). Alele-Williams (1998), asserted that there is a need to focus on teacher's adequacy and competency with respect to their pedagogical practices, strategies, mastery of the curriculum and subject content. Ijaiya (1998) concurred and opined that improving the quality of the teaching force in school is seen as the key to raising students' achievement.

Ezezobor (1986), opined that one of the key factors responsible for the success of students' academic achievement in school is the teacher. In the same vein, Carr (2006) believed that teacher's qualifications and exposure can go a long way to bring about pupil's high academic achievement. Darling - Hammed (2003) also agreed that shortage of qualified teachers is responsible for the poor academic achievement observable among students. In some cases researchers have proved that teacher's competence, professionalism and teaching experience also affects students' performance in mathematics (Golberg, 2010; Olaleye 2011; Oloyede, 2006). Golberg (2010), remarked that high quality teachers are education's best resources and assets because teachers are either the source of knowledge to students or guides to students' acquisition of knowledge. Farrell (2003) defined competence as the ability of a teacher to teach in an effective and a satisfactory way. According to her, a competent mathematics teacher is a teacher with good academic and pedagogical backgrounds, who is not easily worn out by the "system". She identified two indicators of teacher's competency in mathematics teaching and learning as mastery of the content matter and developmental of pedagogical components. She therefore concluded that there is a high correlation between what teachers know and what they teach. This implies that the ability to teach effectively depends on the teacher's competence.

Efficiency is another factor identified as determinant of poor academic achievement of students in mathematics. According to Onyeachu (1996), efficiency can be defined as the ability to do things successfully without wasting time, energy, effort and resources in the classroom. The influence of teachers' teaching effectiveness on the learning outcome of students as measured by students' academic performance has been the subject of several studies (Adediwura and Tayo, 2007; Belts, Zatt & Rice, 2003; Oladele, 2004). Belts, Zatt and Rice (2003), suggested that efficient teaching is a significant predictor of students' academic achievement in mathematics. Apata (2007)

remarked that teachers' experience serves to nourish teachers through exposure to training and socializing them into teaching culture that translates into good pedagogic technique and problem solving strategies required of students. Gibbons, Kimmel and O'Shea (2007), found that experienced teachers were more productive than their inexperienced counterparts. This implies that teacher's teaching experience is a determinant factor in students' academic performance and this remained true even after controlling other teacher's variables like teacher professional development, teacher classroom practices, class size and students' demographics (Oladele, 2004; Avramidis, 2007).

According to Avramidis (2007), teacher's teaching experience referred to the knowledge or skills a teacher gained over the number of years of teaching a particular subject like mathematics. Oladele (2004), submitted that the teaching experience of teachers are significantly related to their teaching effectiveness, while Adeyemi (2011), opined that teaching experience is a critical element in students' learning outcomes in secondary school. According to him, schools that employed teachers with five years or more of teaching experience achieved better result than schools having teachers with less than five years of teaching experience. Similarly, Rice (2003) reported that teachers become more skilful through experience in the job. According to her, one common indicator of teacher's competence is teaching experience.

Age of the mathematics teacher is considered one of the variables that may likely affect the academic achievement of students in mathematics. This is because as mathematics teacher advance in age he is expected to have better mastery of contents, better utilization of educational resources, motivational techniques and effective contents delivery. According to Olaleye (2011), teaching demands a lot of energy and younger teachers are probably more up-to-date with national curriculum and examination requirements while older teachers probably wants to get away from this straitjacket. According to him, young graduates have more up to date knowledge and enthusiastic for the subject while the older teachers and those above 45 years might not see anything spectacular in the teaching and learning process again. These set of teachers see themselves as winding up for their retirement and can no longer kill themselves. This was supported by Rivkin, Hanushek and Kain (2005) who found that teachers' age was significantly related to students' achievement.

Statement of the Problem

Mathematics as a core subject in secondary school has not been having a good number of students performing well in it. If the factors affecting good performance of students in mathematics is not well identified and treated, the situation will remain the same. Teachers have been identified to have an important influence on students' academic achievement and also play a crucial role in educational attainment. However, some teachers are not graduate of mathematics education and do not possess the qualities to adequately impart knowledge in students. Thus, this study sought to investigate the extent to which teachers' variables like competence, efficiency, experience and age predicts students' academic achievement in senior secondary school mathematics in Ogun State, Nigeria.

Research Questions

Following the purpose of the study, two research questions were raised:

1. What is the composite contribution of the four predictor variables (teachers' competences, efficiency, age and experience) on students' academic achievement in mathematics?
2. What is the relative contribution of each predictor variable on student academic achievement in mathematics?

Methodology

Research Design

The study adopted a descriptive survey research design as the independent variables were not manipulated or controlled by the researchers because they had already occurred in the population.

Population

The target population for this study comprised all the public senior secondary two (SS2) students and mathematics teachers in Ogun State, Nigeria.

Sample and Sampling Techniques

The study used multistage sampling technique to select 300 students and 30 mathematics teachers. At the first stage, the researchers randomly selected one senatorial zone in Ogun State, Nigeria. At the second stage, three local government areas (LGAs) were randomly selected from the selected senatorial zone (OGUN EAST SENATORIAL). At the third stage, the proportionate sampling technique was used to select a total of 30 senior secondary schools from 42 senior secondary schools in the three LGAs selected and this represented a total of 71 percent of the entire schools in the three LGAs selected. At the

fourth stage, simple random sampling technique was used to select a total of 10 SS2 students and one mathematics teacher from each of the participating schools. Altogether a total of three LGAs, 300 students and 30 teachers were involved in the study. The distribution is as follows:

Table 1: Distribution of Selected LGA and Senior Secondary Schools.

Zone	S/N	Selected LGA	No of SSS in selected LGA	No of selected SSS LGA	No of students in Selected School
OES	01	Ijebu –Ode	14	14/42x30=10	10x10 = 100
OES	02	Odogbolu	17	17/42x30=12	10x12 = 120
OES	03	Ikenne	11	11/42x30=8	10x8 = 80
TOTAL			42	30	300

Table 1 gives summary of the number of schools and students used in each of the selected LGA.

Instrumentation

In order to collect data and provide answers to the research questions raised, the following research instruments were developed and employed by the researchers: (i) Perceived Teachers' Competence Questionnaire (PTCQ). (ii) Perceived Teachers' Efficiency Questionnaire (PTEQ) (iii) Teachers Experience Questionnaire (TEQ) (iv) Mathematics Achievement Test (MAT)

Perceived Teachers' Competence Questionnaire (PTCQ)

The instrument was developed by the researchers to obtain information on the level of competence of the mathematics teacher in each of the participating school. Thus, it is to be responded to by the students. The instrument was of two sections A and B. The section A of the questionnaire was designed to obtain information on the demographical data of the respondents in terms of school name, local government area, class, age and gender. The section B on the other hand was used to elicit information on how students perceived their teacher's competence. The instrument is made up of 20 relevant items with four point likert scale ranging from "Strongly Agree" to "Strongly Disagree". The respondents ticked any of the points that best addressed their opinion about each item in the PTCQ.

Perceived Teacher's Efficiency Questionnaire (PTEQ)

The instrument was developed by the researchers to obtain information on the level of efficiency of the

mathematics teacher in each of the participating school. Thus, it is to be responded to by the students. The questionnaire was designed to elicit information on how students perceived their teacher's efficiency. The instrument is made up of 20 relevant items with four point likert scale ranging from "Strongly Agree" to "Strongly Disagree". The respondents ticked any of the points that best addressed their opinion about each item in the PTEQ.

Teachers Experience Questionnaire (TEQ)

The instrument was developed by the researcher to obtain information on the level of experience of the mathematics teacher in each of the participating school. Thus, it is to be responded to by the teachers. The instrument was designed to obtain information on the demographical data of the respondents in terms of school name, local government area, class, age, gender as well as to elicit information on number of years spent in teaching Mathematics. The respondents ticked any of the points that best addressed their opinion about each item in the TEQ.

Mathematics Achievement Test (MAT)

To measure the achievement of students in the subject, a Mathematics Achievement Test (MAT) was developed by the researchers using a table of specifications to generate 50 items for students' mathematics tasks. The test is a multiple-choice objective test with five options A, B, C, D and E. The items were based on the common topics found in the schemes of work of the schools used for the study. The common topics were 10 in number as the content areas of these topics were identified and the educational objectives were specified at the following levels: Knowledge, Comprehension and Application. Before bringing the test items to the point of administration, they were subjected to expert opinion of four secondary school teachers to remove the ambiguities and irrelevancies associated with the items. 30 out of the original 50 items were used.

Validity of the Instruments

For the purpose of this study, both the face and content validity of the instruments were ensured. To ensure face validity of the instruments, the initial drafts of the instruments were scrutinized by the researchers to check for all non-technical flaws in the instrument through validation in order to ensure that the instruments actually measure what they were intended to measure in relation to the research questions. The final version of the instruments was trial tested on a sample of 50

students and 10 mathematics teachers who were not part of the real sample. The data collected showed that the respondents did not have problems responding to the items in the questionnaire.

Reliability of the Instruments

The Cronbach alpha was used to determine the reliability of PTCQ with the coefficient of 0.81 and PTEQ with the coefficient of 0.89; while Kuder Richardson formula - 20 was used to estimate the MAT internal consistency as 0.74.

Procedure for Data Collection

The researchers administered the instruments to the respondents with the help of three research assistants and the mathematics teachers of the participating schools. The instruments were collected back on the spot while data collection lasted for 20 days.

Method of Data Analysis

Regression analysis was used to analyze the data collected.

Results and Findings

Question 1: What is the composite accountability of the four predictor variables (teachers' competence, efficiency, age and experience) on students' achievement in mathematics?

Table 2: Composite accountability of teachers' competence, efficiency, age and experience on achievement in mathematics

R	R ²	Adjusted R ²	F	Sig
0.747	0.558	0.487	7.895	0.00

From Table 2, the value of R (0.747 at $P = 0.00 < 0.05$) indicates a significant relationship between teachers' competence, efficiency, age and experience combined on students' academic achievement in mathematics. R² of 0.558 accounts for 55.8% of 1 degree of the variance in students' academic achievement in mathematics. The predictive strength ($F = 7.895$ at $0.00 < 0.05$) of the teachers' competence, efficiency, age and experience combined on students' academic achievement in mathematics.

Question 2: What is the relative contribution of teachers' competence, efficiency, age and experience on student achievement in mathematics?

Table 3: Relative contribution of teachers' competence, efficiency, age and experience on Mathematics achievement

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Tolerance	VIF
	B	Std. Error	Beta				
1 (constant)				-	.023		
Teachers' Competence	-21.132	.697	.537	2.430	.001	.823	1.215
Teacher's efficiency	.168	.046		3.665	.033	.949	1.053
Teacher's age	.278	.123	.308	2.261	.752	.443	2.258
Teacher's experience			-.064		.032	.507	1.973
				-.320			
	.022	.070	.423				
	.861	.380		2.265			

* $p < 0.05$

From Table 3, the B coefficient of 0.168 at $0.001 < 0.05$ for teachers' competence, 0.278 at $0.033 < 0.05$ teachers' efficiency and 0.861 at $0.032 < 0.05$ teachers' experience indicates the significant contribution of the variables to students' academic achievement in mathematics. The positive B coefficient for teachers' competence, efficiency and experience show that the three variables have positive influence on students' academic achievement in mathematics. The tolerance value which is greater than 0.1 and VIF that is less than 10 indicates that there is no multi-collinearity effect of the variables.

Discussion of Findings

This study investigated teachers' variables as determinants of students' academic achievement in mathematics in Ogun State, Nigeria. The study found that teachers' age has no significant relative effect on students' academic achievement in mathematics. The finding concurred with Darling-Hammond (1999) who concluded that there was no significant effect between teachers' age and students' academic achievement. The teachers' competence is the best predictor of students' academic achievement in senior secondary school mathematics among the studied sample followed by teachers' experience and teachers' efficiency, while teachers' age was the least predictor. Adeyemi (2011) said that experience improves teaching skills and students learn better in the hands of teachers who have taught them continuously over a period of years. Similarly, Rice (2003) reported that teachers become more skilful with experience. Onyeachu (1996) found that there is a positive relationship between teacher's efficiency and students' academic achievement while Rice (2003) found that teachers' experience had a positive and significant effect on students' academic achievement. This was supported by Oladele (2004), who found that

teachers' experience and efficiency are the prime predictors of students' academic achievement.

It could then be concluded that the teacher as a major role player in the teaching and learning process should take into cognizance the significance of imparting right knowledge that would improve the teaching/learning of mathematics in the senior secondary school. This result points to the fact that mathematics is a disciplined subject and a lot of attention should be paid to the teachers who teaches the subject. Finally, teacher should be exposed to constant and continuous workshop and seminars to learn new strategies in problem solving to meet the demand of the subject.

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

- (i) Government should provide more teaching learning facilities in schools to make the teaching and learning environment more attractive to students and teachers.
- (ii) Appointment of only professionally trained teachers with relevant certificates at all levels of the educational institutions should be employed to take mathematics at the senior levels.
- (iii) Seminars, workshops and in-service-training should be organized for the teachers to keep them informed about the latest development in mathematics.

References

- Abimbade, A.A. (1998). Teaching and teacher preparation in the twenty-first Century. *Department of Teacher Education.Record, 91(2), 191-208.*
- Adediwura, A.A. and Tayo, B. (2007). Perception of teachers' knowledge, attitude and teaching skills as predictor of academic performance in Nigerian secondary schools. *Educational Research and Review, 2 (7), 165-171.*
- Adeleke, J.O. (2007). Identification and effect of cognitive entry characteristics on students' learning outcomes in bearing in mathematics. Unpublished Post Field, Institute of Education, University of Ibadan.
- Adeyemi, B. (2011). Teacher related factors as correlates of pupils achievement in social studies in South West Nigeria. *Electronic journal of Research in Educational psychology, 8(1), 313-332.*
- Akinsola, M.K. (1993). Comparative effects of mastery learning and enhanced mastery learning strategies on students' achievement and self-concept mathematics. A Ph.D Thesis

- in the Department of Teacher Education, University of Ibadan, Ibadan, Nigeria
- Alele-William, G. (1988). Keynote address delivered at the silver jubilee meeting of Mathematics Association of Nigeria (MAN) Sept. 1988. *Abacus* 18(1), 15-19.
- Apata, F.S. (2007). Influence of teachers' academic qualification and experience on students' performance in senior secondary school physics in Nigeria. Unpublished M.Ed. Research Project. Science Education Department, University of Ilorin, Ilorin, Nigeria.
- Avramidis, E. (2007). The influence of teaching experience and professional development on students' academic performance in Mathematics. *European Journal of Special Needs Education*, 22(4), 367-389.
- Belts, J.R.; Zatt, A.C. and Rice, L.A. (2003). Determinants of students' achievement: New evidence from San Diego, San Francisco Public Policy Institute of California. Retrieved from <http://www.ppic.org/content/pubs/report/R-803JBR.pdf>
- Carr, M. (2006). The determinants of students' achievement in Ohio's public schools (Policy report), Columbus, OH: Buckeye Institute for Public Policy solution. Retrieved from http://www.buckeyeinstitute.org/docs/policy_report_determinants_of_students_achievement_in_Ohio.pdf
- Darling-Hammond, L. (2000). Teaching quality and students' achievement. *Journal of Teacher Education*, 51(3), 166-173.
- Ehinder, O.J. (2000). What our student say about how we teach. *Ife Journal of Educational Studies*, 7(1), 1-9.
- Ezezobor, S.A. (1986). The challenge of students under achievement in science. *Journal of Research in Science Teaching*, 54(1), 78-91
- Farrell, T. (2003). Reflective teaching: Principles and practice. *English Teaching Forum*, 41(4), 14 - 21.
- Gibbons, S.; Kimmel, H. and O'Shea, M. (2007). Changing teacher behaviour through staff development: Implementing the Teaching and Content Standards in Science. *School Science and Mathematics*, 76(1), 302-340.
- Golberg, G.A. (2010). Teacher expectations and academic achievements. *The Urban Review*, 16(2), 37 - 49.
- Ijaiya, N.Y. (2000). Failing schools' and national development: Time for reappraisal of school effectiveness in Nigeria. *Nigeria Journal of Educational Research and Evaluation*, 2(2), 42-49.
- Obemeata, J.O. (1992). Raising the standard of performance in public examinations in Nigeria. A paper Presented at a Workshop Organized by the West African Examinations Council, Lagos.
- Odugwu, H.N. (1994). Primary school teachers and the teaching of time concept in schools. *Journal of Education Today*, 7(2), 118-130.
- Oladele, O. (2004). Improving the teaching and learning of mathematics in secondary schools. *Oyo State Mathematics Conference Paper*.
- Olaleye, F.O. (2011). Teachers' characteristics as predictor of academic performance of students in secondary schools in Osun State, Nigeria, *European Journal of Educational Studies*, 27(1), 43 - 57.
- Oloyede, D.O. (2006). Teacher qualification and experience as predictor of their job performance. *Journal of Educational Focus*, 7(1), 1 - 11.
- Onyechu, A. (1996). Relationship between working conditions and teacher effectiveness in secondary schools in Abia Educational zone of Abia State, M.Ed Dissertation Unpublished, Port Harcourt, Nigeria.
- Rice, J.K. (2003). Teacher quality effectiveness of teacher attributes (Washington D.C. Economic Policy Institute.
- Rivkin, S.G.; Hanushek, E.A. and Kain, J.F. (2005). Teachers, schools and academic achievement (working paper 6691, revised). Cambridge, MA: National Bureau of Economic Research.