School Variables and Senior Secondary Students' Achievement in Mathematics in Rivers State, Nigeria

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Doi:10.5901/mjss.2013.v4n2p709

Abstract

This research study focused on the relationship between school variables and students' achievement in mathematics at the senior secondary II level in Rivers State, Nigeria. The ex-post-factor research design was adopted for this study since already conducted mathematics test scores of the students were retrieved and used for the analysis. Furthermore, data were elicited through the school variables and students achievement in mathematics questionnaire (SVASAMQ). A population of 10,373 comprising of senior secondary II students and principals were involved in the study; out of which 4661 were chosen for the sample using the Yarrow Yamen's formula. The data were analyzed using the Z-test statistic, means and simple percentages. The findings were that there is a significant relationship between teacher quality, school academic climate and students' achievement in mathematics. Hence some recommendations were made.

Key words: *School variables, mathematics achievement, school academic climate, teacher quality.*

1. Introduction

This research study focused on the school variables and students' achievement in mathematics at the senior secondary school level in Rivers State, Nigeria. The concept of school variables in this study involved the teacher quality and school academic climate. There is a wide spread interest in improving the levels of mathematics achievement in schools. Apart from the economic benefits that it is argued this would bring, by better preparing young people for the numeracy demands of modern work places and raising the skills level of the work place, there are also social benefits tied to improving access for larger numbers of young people to post-school education and training opportunities and laying stronger foundations to skills for life-long learning.

This interest in raising levels of achievement has led to a focus on identifying the range of variables that shape achievement as well as understanding how these variables operate to limit and enhance the achievement of different groups of students. Such major variable to be considered in this study is the school variable. In our research context, though school variable means the teacher quality, school resources available, school academic climate and incentive schemes offered in the school, we shall consider two of these variables, namely teacher quality and school academic climate.

However, recent work on differences in mathematics achievement has highlighted the importance of classroom, teacher and school factors. The Third International Mathematics and Science Study TIMSS (2002) focused on variables such as the student, classroom and school factors; how they relate or influence mathematics achievement in Australia and the United States (US). It found that classroom differences account for about one-third of the variation in student achievement in the US and over one-quarter in Australia. Most of the classroom variations in both countries was due to compositional and organizational factors, very little of it due to differences between teachers. This has important implications for policy regarding the improvement of mathematics achievement. It suggests that school systems may gain little by targeting teachers only, and need to give consideration to the role of pupil grouping practices and the effects of tracking and streaming on classroom learning environment.

Furthermore, Lamb and Fullarton (2000) conducted a study in Australia by utilizing the Third International Mathematics and Science Study TIMSS data and found that although student background variables influences differences in achievement in mathematics, classroom and school variables also contribute substantially. Also early

literature on school effectiveness placed an emphasis on the ability and social backgrounds of students as factors that shape academic performance, and suggested that schools had little direct effect on student achievement.

Coleman et al (1996), for example in a major study of US school seemed to cast doubt on the possibility of improving school achievement through reforms to schools. They found that differences in school achievement reflected variations in family background and the family backgrounds of student peers and concluded that schools bring little influence to bear on a child's achievement that is independent of his background and general social context.

However, Scheerens (1993), Schreerens et al (1989) and Pelgrum (1989) conducted several studies and concluded that classrooms as well as schools are important and that teacher and classroom variables account for more variables than school variables. Schmidt et al (1999) in their comparison of achievement across countries using TIMSS data report that classroom level differences accounted for a substantial amount of variation in several countries including Australia and the US.

Considering the Nigerian environment and Rivers State in particular, the literature on school variable, such as school academic climate and students' achievement in mathematic is scanty. Hence, the need to investigate the extent to which teacher quality and school academic climate relate to students' achievement in mathematics.

2. The Problem

Odubona (2001) had posited that mathematics is the pivot around which the whole essence of living revolves and the basis for scientific and technological take off. Yet, Ahiakwo (2006) found that the performance of various levels of students has decelerated over the years with that of Nigerian children quite remarkable. The Chief Examiners' Reports of results of our public examinations (WAEC, 2004-2009)has shown markedly a decline in the percentage of passes in mathematics. Hence, the prevailing underachievement in mathematics portends an indicator of wastage in human and material resources, a catalyst to the development of an antiscience culture and ultimately an evolution of scientifically illiterate citizenry.

Furthermore, Oyekan (1995) had earlier defined underachievement as performance that is below an acceptance standard in the master of subject matter or skills within a given limit. This existing underachievement might be the root cause of avid criticism and dissatisfaction averred against the schools by the public. Should this be viewed as a savage affront to the teachers or an expressive demand for accountability? Apparently, the recurrent thorny issue of students' poor academic performance in mathematics poses a genuine problem with protrusive impact on all levels of education and development. Considered all round, it is an antithesis to a developing country crusade to scientific literacy and industrial self-reliance. Do these aggregate views suggest a likely relationship between school variables and students' achievement in mathematics? To what extent do teacher quality and school academic climate relate to students' achievement in mathematics at the senior secondary school II level in Rivers State, Nigeria. This research is poised to investigate these phenomena.

3. Theoretical Background

a) Teacher Quality and Students' Achievement in Mathematics

The concept of teacher quality means the teacher qualification, teaching experience, training before joining and the in-service training attained. Greenberg et al (2004) in their study on the relationship between the teacher quality and students' achievement in mathematics found that teacher certification and teacher experience were strongly associated with higher students' achievement in mathematics. There were also significant associations between higher degrees of education or teaching experience with achievement in mathematics. Furthermore, certified teachers were defined as teachers holding a professional regular certificate to teach their subject field. All other teachers with temporary or provisional licenses were defined as uncertified since they did not possess the certification standards.

Lee and Fradd (1996) posited that the teacher is the primary factor in school and much depends on him to promote students' higher order thinking skills which are required for academic success. Grandall (1994) had earlier reiterated the importance of teacher training when he said "teachers can provide an insight into linguistic and communication activities". In his views, Ibebuike (1986) had earlier noted that many students, even as far back as their primary school time, do not take interest in mathematics to a meaningful degree. He remarked that methods of instruction were not very favourable to these students partly because of the fewness of mathematics teachers who are over overlaboured and because of the degree of thoroughness of the knowledge of the subject by some teachers.

He recommended that more trained mathematics teachers be provided in our secondary schools. It was in his candid opinion that such a measure will increase the learning, rate of mathematics in our schools and reduce the fear to this universal subject. He then wondered how poor quality of teaching due to the induced low morale among teachers and hence poor students' performance in mathematics would help matters. Kentu (1986) had harped on the percentage of teachers qualifying as mathematics teachers yearly. He noted that such percentage has not exceeded one percentage of the graduates. In essence, the quality and quantity of teachers are seen as the determining factors to the advancement of the subject. Ayotunde (1989) saw lack of qualified teachers as the most prevalent constraint to the teaching of mathematics in Nigerian secondary schools. In his survey, 41.2 percent of schools indicated "lack of qualified teachers as very serious", while 27.5 percent sees it as "serious" and 31.3 percent sees it as not serious".

Further, in his studies on the qualification of teachers in science, mathematics and technical education, he remarked that "it seems therefore that the most problematic areas in respect to qualified teachers are mathematics and Agricultural Science". Ojo (1986) in his paper "improving mathematics teaching in our schools, identified the teacher problem as one of the problems of teaching mathematics. He contended that the teacher based problems in mathematics instructions are primarily of two types – quantity and quality.

On the quantity, he asserted that qualified teachers in mathematics are in short supply. The dearth is world-wide, but it is more acute in countries which are in a hurry like Nigeria. While on the quality it is argued that most grade II teachers in the primary schools failed mathematics while most secondary school mathematics teachers, especially in recent times are graduates of subjects other than mathematics. The caliber consists of people with H.N.D (photogrammetry), HND (textile technology), OND (town planning), B.Sc (Economics), B.A (Sociology) etc.

It is no wonder that status of the teaching profession in our society is low as the majority entering it do so because they failed to obtain employment in positions for which they are better qualified. He posited that this group of teachers are "birds of passage" lacking in the necessary motivation for teaching and contributing to the high rate of attrition and instability in the profession.

On teacher training, Fagbemi (1987) and WAEC (1986) earlier found that decline in teacher performance could be traced to low esteem and shortage of trained teachers, irregular inspection and supervision of instruction, massive admission of secondary school dropouts into teachers training colleges, and lack of formal training in education by most teachers, trainers. Furthermore, the presence of fake and unqualified teachers with forged certificates and degrees might have worsened the matter. There is the likelihood that such deficient teachers would resort to stodgy teaching skills, become resistant to accept change in the mathematics curriculum and exhibit capricious complacement towards pupils academic progress. They cannot after all display maximal competence and dexterity associated with tangible mathematics instruction. Hence, their insipid, performance may continually act as a catalyst towards students' underachievement and hatred of mathematics.

b) School academic climate and students' achievement in mathematics

School academic climate connotes supervision of class, home task given, home task correction, preparation and utility of teaching aids, teacher regularity and commitment. Oyekan (1995) had enumerated various problems related to underachievement in mathematics to include poor supervision of class by teachers, poor supervision of home task given to the students and poor preparation and utility of teaching aids by teachers.

However, the most recent analysis of TIMSS data revealed that the most important instructional variable for science students in high performing versus low-performing schools was whether science was taught as a discovery activity with emphasis on students carrying out experiments and practical investigations.

Furthermore, an instruction variable in mathematics is whether teachers frequently check mathematics homework in class so as to assess and support full understanding (Martin et al., 2000).

Supporting the views of Martin and associates, Harris (1995) had reiterated the need for emphasis to be placed on hands-on-experience of students in mathematics and science rather than learning terminology. Some of the instructional adaptations recommended include the following:

i) Breaking down difficult ideas into more understable segments.
ii) Pausing often enough to allow students to catch up and process the words the teacher has been using.
iii) Stressing the main word or idea
iv) Using synonyms for important words
v) providing a handout that students can use to follow the discussion
vi) Demonstrating whenever possible in ways that supplement spoken or written instruction.

Commenting further on school academic climate, Papanastatinu (2001) showed that school climate was influenced by the educational background, hence achievement in mathematics. The videotape study of TIMSS 1995 from different countries (Japan, Germany, and USA) showed that outside interruptions affect the flow of the lesson and detract from instructional time. Internationally, in TIMSS 1999 for both mathematics and science, about one-fifth of the students reported that their classes were interrupted pretty often or almost always (Mullis et al., 2000).

Betts et al., (2003) had argued in their study that the percentage of days a student was absent was a strong negative predictor of each student gain in achievement mathematics. Perhaps the next most consistent finding was that an individual student made much more academic progress in a school year in which he or she was surrounded by peers in his or her grade who had high scores of the prior springs test. A strong but less consistent finding was that the average initial test scores of a students' peers in his or her classroom also influenced his or her learning. Among other factors, researchers have found that class size does influence reading achievement in the elementary grades, but found no evidence that class size matters in middle and high schools. In general, class size appears to matter more in lower grades than in upper grades where as teacher qualification such as experience, level of education and subject area knowledge appear to matter more in the upper grades. Ocheng (1996) had earlier conducted a study on the effect of classroom environment on students' satisfaction and achievement suggesting that classroom climate and management style contribute differently towards different aspects of achievement.

Singh and Saxena (1995) found that school level factors of academic climate (test and feedback, homework teachers' quality) are the prominent contributors to learning achievement in mathematics. Jain and Arora (1995) conducted a study on the effect of school-level variables on achievement and found that the continuous stay of teachers for not more than five years in the same school, proper qualification are likely to improve the performance of primary education.

Furthermore, Sahoo (1998) and Brabhan (1999) had earlier conducted a study on the effects of school-related factors and found that regularity in home task giving and correction have positive effects on enhancing learning achievement. On teacher regularity to class and commitment in the teaching process, Nwosu (2002) posited that a number of reasons have been advanced by researchers on why available resources for mathematics teaching have not been effective. They include incompetence of mathematics teachers, lack of commitment of mathematics teachers, defective training given to mathematics teachers and high teacher/student ratio.

He further explained that there is lack of commitment caused mainly by the mathematics teachers' negative attitude to their work. All these speak nothing but students under-achievement in the subject. The pattern of training of mathematics teachers has remained predominantly traditional for too long and there is no opportunity to retrain and update the teachers' knowledge to function to expectation. Worse still our training institutions are concerned with the covering of the prescribed syllabus or curriculum, rather than train than to satisfy their professional career. Earlier in his study, Nwosu (2000) found that the little or non-use of resources by teachers of mathematics made it difficult for students to achieve more in mathematics. He further stated that non-use of classroom resources have been attributed to teachers' lack of knowledge and skills required to put such resources into productive use. This he stressed has caused poor performance of students in mathematics. On the other hand, use of resources depends on the teachers' perception of the materials and this varies from one teacher to another. In our classrooms today, he stressed, there are different types and classes of teachers. They include:

a) A qualified teacher
b) A professional teacher
c) An expert or experienced teacher
d) A novice (beginning) teacher and
e) A postulant/auxiliary teacher

These types of teachers, he stressed, have their impacts in the teaching and learning process. The question now comes – to what extent does school academic climate relate to students' achievement in mathematics? Hence, is there any significant relationship between school academic climate and students' achievement in mathematics in the senior secondary II level in Rivers State, Nigeria? This research study is poised to investigate this phenomenon.

4. The Method

The ex-post-facto research design was adopted for this study because it seeks to investigate an existing phenomenon regarding students' achievement in mathematics. School variables investigated include teacher quality and school academic climate and their relationship with students' achievement in mathematics. The population of the study consisted

of all the 253 senior secondary school principals and 10,120 senior secondary school II students (SS2) in 23 local government areas of Rivers State, Nigeria. This gave a total population of 10,373. The sample size for the study consisted of 4510 senior secondary II students and 151 principals selected from 253 government owned secondary schools in Rivers State, Nigeria. To determine the sample size for the study the Yarro Yamen's formula for sampling was applied. Based on this formula, a sample size of 4661 subjects were determined. However, the simple random sampling method was used to select the principals.

Table 1: Distribution of population of 10,120 senior secondary II students and 253 principals of Rivers State, Nigeria.

S/No	Local Government area	No. of schools	Population of students (SS2)	Sample of students (SS2)	Principals	
					Pop	sample
1	Abua/Odual	440	209	11	11	7
2	Ahoada-East	12	480	218	12	7
3	Ahoada-West	13	520	226	13	8
4	Akuku-Toru	8	320	177	8	5
5	Andoni	10	400	200	10	6
6	Asari-Toru	8	320	177	8	5
7	Bonny	13	520	226	13	8
8	Degema	12	480	218	12	7
9	Eleme	6	480	218	12	7
10	Emohua	19	760	262	19	11
11	Etche	19	760	262	19	11
12	Gokana	12	480	218	12	7
13	Ikwerre	13	520	226	13	8
14	Khana	22	880	275	22	13
15	Obio/Akpor	16	640	246	16	10
16	Ogu/Bolo	3	120	92	3	2
17	Okrika	6	240	150	6	3
18	Omuma	3	120	92	3	2
19	Ogba/Egbema/Ndoni	15	600	240	15	9
20	Opobo/Nkoro	3	120	92	3	2
21	Oyigbo	4	160	114	4	2
22	Port Harcourt	15	600	240	15	9
23	Tai	10	400	200	10	6
	Total	253	10,120	4510	253	151

The research instrument is the school variables and students' achievement in mathematic questionnaire (SVASAMQ) divided into five sections. To elicit data from the respondents, the instrument was constructed using the following scale:

1. Very high extent (VHE) = 4
2. High extent (HE) = 3
3. Low Extent (LE) = 2
4. Very low extent (VLE) = 1

The respondents were free to indicate (√) in the column against each of the items as it applied to them (see appendix). A decision cut of point of 2.50 was adopted. Any item or component in which the respondents have a mean score of 2.50 and above was regarded as a "high extent", while a mean score below 2.50 was regarded as "a low extent".

Descriptive and inferential statistics were adopted for this study. In the descriptive statistics, means $(\bar{X})$, variance (δ^2) and standard deviation (δ) were computed and tables constructed. Deductions made from results on these tables formed the answers to the research questions (1, 2). To test the hypotheses (1 and 2), the Z-test statistic was applied to compare the means of the various variables and those of achievement in mathematics. The 0.05 level of significance was adopted with the degree of freedom as df = $N_1 + N_2 - 2$

5. Results and Discussion

Research Question 1: To what extent does teacher quality relate to students' achievement in mathematics?

Table 1: Analysis of the opinions of principals on teacher quality and students' achievement in mathematics at the senior secondary II level in Rivers State, Nigeria.

S/N	Question Items	VHE (4)	HE (3)	LE (2)	VLE (1)	Total	Mean $\overline{X}$	Percentage rating (%)
1	To what extent do you have qualified teachers in mathematics?	20 (80)	23 (69)	75 (150)	33 (33)	151 (332)	2.20	55.00
2	To what extent do you have teachers with cognate experience?	30 (120)	45 (135)	56 (112)	20 (20)	151 (387)	2.56	64.00
3	To what extent were your teachers properly trained before joining the school?	17 (68)	26 (52)	73 (146)	35 (35)	151 (310)	1.99	49.75
4	To what extent do your teachers posses in-service training?	22 (88)	21 (63)	78 (156)	30 (30)	151 (337)	2.23	55.75
5	To what extent were maths teachers in your school interviewed before being employed?	45 (180)	56 (168)	40 (80)	10 (10)	151 (438)	2.90	72.50
6	To what extent do your maths teachers attend seminars and workshops on mathematics?	42 (168)	58 (174)	40 (80)	11 (11)	151 (433)	2.86	71.50
7	To what extent were unqualified teachers in your school sent on pedagogical training?	50 (200)	58 (174)	36 (72)	7 (7)	151 (453)	3.00	75.00
8	To what extent do your maths teachers communicate effectively?	46 (184)	58 (174)	35 (70)	12 (12)	151 (443)	2.93	73.25
9	To what extent does the certification of your teachers influence your achievement in maths	53 (212)	56 (168)	35 (70)	7 (7)	151 (457)	3.03	75.75
10	To what extent does the relationship between maths teachers and the class influence students achievement in maths?	25 (100)	50 (150)	53 (106)	23 (23)	151 (379)	2.51	62.75
11	To what extent does mathematics teachers' ability to set examination questions influence your achievement in mathematics?	43 (172)	56 (168)	40 (80)	12 (12)	151 (432)	2.86	71.50
12	To what extent does the mathematics teachers ability to evaluate the answers to mathematics questions influence your achievement in mathematics	48 (192)	53 (159)	41 (82)	9 (9)	151 (442)	2.93	73.25
	Group Mean Rating $\left(\overline{X}\right)$ =						2.67	66.75

Table 1 revealed that the summary result of the total opinion of principals on the relationship between teacher quality and achievement in mathematics was 2.67 indicating a percentage of 65.0. Furthermore, the decision rule says that the mean of the scale used is 2.50 making any score above 2.50 to show a "high extent" teacher quality is related to students' achievement in mathematics. It also indicates that any score below 2.5 means to a "low extent" teacher quality is related to students' achievement in mathematics. Therefore, the score above shows that to a "high extent" teacher quality is related to students' achievement in mathematics.

Research Question 2: To what extent does school academic climate relate to students' achievement in mathematics?

Table 2: Analysis of the opinion of students on school academic climate and achievement in mathematics at the senior secondary II level in Rivers State, Nigeria

S/N	Question Items	VHE (4)	HE (3)	LE (2)	VLE (1)	Total	Mean $\overline{X}$	Percentage rating (%)
1	To what extent is the mathematics class always properly supervised by the teachers?	981 (3924)	1184 (3552)	1579 (3158)	766 (766)	4510 (7721)	2.53	63.25
2	To what extent does the mathematics teacher give home assignment after each lesson?	1161 (4644)	1454 (4362)	1691 (3382)	204 (204)	4510 (12592)	2.79	69.75
3	To what extent does the mathematics teacher correct home assignments?	1004 (4016)	1015 (3045)	1860 (3720)	631 (631)	4510 (11412)	2.53	63.25
4	To what extent does the mathematics teacher prepare teaching aids for mathematics lessons?	767 (3068)	936 (2808)	2356 (4712)	451 (451)	4510 (11039)	2.45	61.25
5	To what extent does the mathematics teacher use the teaching aids for mathematics?	733 (2932)	981 (2943)	2300 (4600)	496 (496)	4510 (10971)	2.43	60.75
6	To what extend do mathematics teachers punish behavioural disturbances in the mathematics class?	1015 (4060)	1409 (4227)	1635 (3290)	451 (451)	4510 (12008)	2.66	66.5
7	To what extent is your mathematics teacher regular in class?	1150 (4600)	1466 (4398)	1669 (3338)	225 (225)	4510 (12561)	2.79	69.75
8	To what extent is your teacher committed to the teaching of the lesson?	823 (3292)	851 (2571)	1725 (3450)	1105 (1105)	4510 (10418)	2.31	57.75
9	To what extent does your home background influence your school activities?	1071 (4284)	958 (2874)	1522 (3044)	959 (959)	4510 (11161)	2.47	61.75
10	To what extent does the culture of the school location influence your school academic climate?	1184 (4736)	1522 (4566)	1311 (3022)	293 (293)	4510 (12617)	2.79	69.75
11	To what extent does the percentage of days you spend in the class a week influence your mathematics achievement?	1353 (5412)	1759 (5277)	1094 (2188)	304 (304)	4510 (13181)	2.92	73.00
12	To what extent does the size of your class influence your achievement in mathematics?	744 (2976)	970 (2937)	2075 (4150)	712 (712)	4510 (10775)	2.38	54.25
	Group Mean Rating $\left(\overline{X}\right)$ =						2.59	64.95

Table 2 revealed that the summary result of the total opinions of students on the relationship between school academic climate and students' achievement in mathematics was 2.59 indicating a percentage of 64.75. Furthermore, the decision rule says that the mean of the scale used is 2.50, hence any score above 2.5 showed that to "a high extent" school academic climate is related to students' achievement in mathematics. However, any score below 2.5 indicates that to "a low extent" school academic climate is related to students' achievement in mathematics. Therefore, the score above showed that to "a high extent" school academic climate is related to students' achievement in mathematics.

Hypothesis Testing

Hypothesis 1

Ho_1: There is no significant relationship between teacher quality and students' achievement in mathematics

Table 3: Z-ratio test of significant relationship between teacher quality and students' achievement in mathematics.

Variable	$\overline{X}$	Sd	N	df	P	S.Error	Z-cal	Z-Crit	Decision
Teacher Quality	66.75	8.16	151	4659	0.05	0.660	18.46	Z>1.96 Or Z<-1.96	Reject Ho_1
Students' achievement in mathematics	54.00	14.79	4510			0.228			

The result of table 3 showed that the calculated value of Z is 18.46, which is greater than the critical value of 1.96 at the degree of freedom 4659 at the 0.05 level of significance. Since the calculated Z-value is greater than the critical value, the null hypothesis that there is no significant relationship between teacher quality and students' achievement in mathematics is rejected. Hence, there is a significant relationship between teacher quality and students' achievement in mathematics (see appendix for detailed calculations).

Hypothesis 2

Ho_2: There is no significant relationship between school academic climate and students' achievement in mathematics.

Table 4: Z-ration test of significant relationship between school academic climate and students' achievement in mathematics.

Variable	$\overline{X}$	Sd	N	df	P	S.Error	Z-cal	Z-Crit	Decision
School academic climate	64.95	6.29	4510	9018	0.05	0.093	43.38	Z>1.96 Or Z<-1.96	Reject Ho_2
Students' achievement in mathematics	54.09	14.79	4510			0.228			

The result on table 4 showed that the calculated value of Z is 43.38, which is greater than the critical value of 1.96 at the degree of freedom 9018 at the 0.05 level of significance. Since the calculated value is greater than the critical value, the null hypothesis that there is no significant relationship between school academic climate and students' achievement in mathematics is rejected. Hence, there is a significant relationship between school academic climate and students' achievement in mathematics.

6. Conclusion

From the analysis of data and the discussion of findings, the following conclusions were made:

1. There is a significant relationship between teacher quality and students' achievement in mathematics at the senior secondary II level in Rivers State, Nigeria.
2. There is a significant relationship between school academic climate and students' achievement in mathematics at the senior secondary II level in Rivers State, Nigeria.

7. Recommendations

Considering the findings and discussions of the study, the following recommendations were made:

1. Since teacher quality was significantly related to students' achievement in mathematics, teachers of mathematics at the secondary II level in Rivers State should possess the requisite qualifications before being recruited to teach. Furthermore, the mathematics teacher should adopt better teaching strategies during the teaching-learning process.
2. That the search light of blame on poor performance in mathematics should be re-focused on areas such as supervision of mathematics classes, home-task given and preparation/utility teaching aids by the mathematics teachers.

References

Ahiakwo, M.J. (2006). Science, Science Education and Scientific literacy. Inaugural Professorial Lecture Series, No. 17,4.

Ayotunde, K. (1989). The teacher factor and achievement in mathematics a the secondary school level. *Journal of Mathematics Education* 3(7), 35-49

Betts, L., Andrew, C., and Lorien, R.A. (2003). New insights into school and classroom factors affecting student achievement. Public Institute of California. *Research Brief* 76(1), 1-2

Coleman, J.S., Denga, L. and Dennis, C. (1996). School and classroom effectiveness. *Australian Journal of Education* 4(3). 40-43
Fagbemi, K. (1987). Understanding the effect of school resources on mathematics achievement. *Journal of Education*, 7(4), 70-75
Grandall, F. (1994). Mathematics teaching in the secondary schools. *Mathematics Research* 3(4), 20-24.
Greenberg, I., Genshatt, W., and Hamachek, K. (2004). Teach quality measures and students' achievement in mathematics. *Research Brief* 2(15), 1-2.
Harris, I. (1995). Teaching difficult topics in mathematics at 'O' and 'A' levels. *School Science Review* 43(220), 110-114
Ibebuike, M. (1986). Methods of instruction and mathematics achievement. *Journal of Education* 11(8), 60-68
Jain, K. and Arora, M. (1995). Improving mathematics teaching in our schools. *Journal of Pedagogy* 5(7), 45-48.
Kentu, M. (1986). The nature of mathematics teaching in the secondary schools. *Journal of Mathematics Education* 6(2), 15-18
Lamb, S. and Fullarton, S. (2000). Classroom and teacher effects in mathematics education beyond 2000. Conference proceedings of the twenty-third annual meeting of the mathematics education. *Research Group of Australia*
Martin, M.O., Mullis, I.V., and Gaig, H. (2000). Effective schools in Science and Mathematics. IEA's *Third International Mathematics and Science Study*. M.A. Boston
Mullis, I.V., Marsh, H.W. and More, J. (2000). TIMSS 1999 International Mathematics report: Findings from IEA's report of the Third International Mathematics and Science Study at the eight grade. Chestnut Hill, M.A. Boston College.
Nwosu, K. (2000). Factors affecting the teaching of secondary school mathematics. *Journal of Mathematics Education* 2(3), 10-12
Ocheng, W. (1996). Improving mathematics teaching in our schools. *Journal of Mathematics Education*. 3(4), 70-74
Odubona, M. (2001). Attitudes and perceptions and mathematics achievement. *Journal of Science Education*. 8(6), 106-108.
Oji, K. (1986). Students' achievement in mathematics. *Journal of Mathematics Education*. 4(3), 10-15.
Oyekan, S.S. (1995). A study of factors associated with the students' achievement in science. Ijotne 4(1 & 2), 94-95.
Papanastatiou, W.C. (2002). Students' attitudes towards mathematics: An empirical study of eight grade Iranian students. *Journal of Science Teaching*. 4(8), 36-40.
Pelprum, K. (1989). Classroom and school factors affecting mathematics achievement: a comparative study of Australia and he United State of America using TIMSS. *Australian Journal of Education*. 3(6), 24-27
Prahhan, M. (1999). Mathematics, curse or anxiety: *Teaching Children Mathematics*. 6(5), 103-105.
Sahoo, W. (1998). Classroom variables and mathematics achievement. *Journal of Mathematics Education*. 21(8), 18-23
Schreenes, W., Vermenlen, K. and Pelarum, M. (1989). Classroom and school effects on mathematics achievement. *Journal of Mathematics Education*. 18(9), 281-286
TIMSS (2000). Third International Mathematics and Science Study. Australia and United States of America.
WAEC (1986). West African Examinations Council Report for Mathematics. yaba, Lagos. Nigeria 71-75.
Lee, M.K. and Fradd, S. (1996). Effective schools in mathematics and science teaching. Boston.
Singh, K. and Saxena, W. (1995). Effect of state intervention on pupils achievement. *National Council of Educational Research and Training*. New Delhi 45-47

APPENDIX 1

Testing Hypothesis 1

Computation of Z-calculated using the group means (U_1 and U_2)

Variables: Teacher Quality and Students' achievement in mathematics.

H_o: $U_1 = U_2$

H_A: $U_1 \neq U_2$

Where:

$U_1 = 66.75$

$U_2 = 54.00$

$N_1 = 151$

$N_2 = 4510$

$\delta_1^2 = 8.16^2$

$\delta_2^2 = 14.79^2$

But $Z_{u1-u2} = \dfrac{U_1 - U_2}{\sqrt{\dfrac{\delta_1^2}{N_1} + \dfrac{\delta_2^2}{N_2}}}$

$= \dfrac{66.75 - 54.00}{\sqrt{\dfrac{8.16^2}{151} + \dfrac{14.79^2}{4510}}}$

$= 18.46$

:. Z-cal = 18.46

Rejection Region: Two-tailed test, thus: Z>1.96 or Z<-1.96.

Level of Significance: α = 0.05

Decision: We reject the null hypothesis. Hence, there is a significant relationship between teacher quality and students' achievement in mathematics.

APPENDIX 2
Testing Hypothesis 2

Computation of Z-calculated using the group means (U_1 and U_2)

Variables: School academic climate and students' achievement in mathematics

H_o: $U_1 = U_2$

H_A: $U_1 \neq U_2$

Where:

U_1 = 64.95

U_2 = 54.09

N_1 = 4510

N_2 = 4510

δ_1^2 = 6.29^2

δ_2^2 = 14.79^2

But Zu1 – u2 = $$\frac{U_1 - U_2}{\sqrt{\frac{\delta_1^2}{N_1} + \frac{\delta_2^2}{N_2}}}$$

= $$\frac{64.95 - 54.09}{\sqrt{\frac{6.29^2}{4510} + \frac{14.79^2}{4510}}}$$

= 43.38

:. Z-cal = 43.38

Rejection Region: Two-tailed test, thus: Z>1.96 or Z<-1.96.

Level of Significance: α = 0.05

Decision: We reject the null hypothesis. Hence, there is a significant relationship between school academic climate and students' achievement in mathematics.

APPENDIX 3
Computation of mean, variance and standard deviation using students' raw scores in mathematics

Class Interval	Frequency (f)	Class mark $(\bar{x})$	fx	$(x-\bar{x})$	$(x-\bar{x})^2$	$f(x-\bar{x})^2$
21-30	428	25.5	10914	-28.598	817.845	350037.66
31-40	508	35.5	18034	-18.598	345.885	175709.58
41-50	631	45.5	28710.5	-8.598	73.925	46646.675
51-60	1173	55.5	65101.5	1.402	1.965	2304.945
61-70	1285	65.5	84167.5	11.402	130.01	167062.85
71-80	440	75.5	33220.0	21.402	458.04	201537.60
81-90	45	85.5	3847.5	31.402	986.08	44373.60
	$\sum f$ = 4510		$\sum f$ = 243,995			$\sum f(x-\bar{x})^2 = 987,672.91$

Mean $\bar{X} = \frac{\sum fx}{\sum f} = \frac{243,995}{4510} = 54.09$

$\delta 2 = \frac{\sum f(x-\bar{x})^2}{\sum f} = \frac{987,672.91}{4510} = 218.99$:. $\sqrt{218.99} = 14.79$

:. δ = 14.7