

SCHOOL QUALITY FACTORS AND SECONDARY SCHOOL STUDENTS' ACHIEVEMENT IN MATHEMATICS IN SOUTH-WESTERN AND NORTH-CENTRAL NIGERIA

Adebola O. Jaiyeoba
Ademola I. Atanda
University of Ibadan

Abstract

This study investigated nine school quality factors that are likely to influence students' achievement in Mathematics in South-Western and North-Central Nigeria. The study adopted the descriptive survey research design of the ex-post facto type and made use of a sample of 1,014 Mathematics teachers and principals selected through a multi-stage sampling procedure. The two validated instruments used were School-based Quality Inventory ($r = 0.89$) and School-Based Quality Factor Questionnaire ($r = 0.92$). Three hypotheses were tested at 0.05 level of significance. Data collected were analysed using means, standard deviation and multiple regression. Out of the nine variables, the two variables that contributed significantly to student's achievement in Mathematics are conveniences and instructional materials ($\beta = 0.130$, $t = 2.381$, $P < 0.05$), ($\beta = 0.134$, $t = 2.470$; $P < 0.05$) respectively. Instructional materials and conveniences (toilets) have been adjudged to have contributed significantly to students' achievement in Mathematics. Therefore, Government and other stakeholders should ensure that schools are provided with effective and adequate toilet facilities. It is also recommended that instructional resources should be provided in schools.

Keywords: influence, conveniences, school factors, supervision, instructional materials

Introduction

Mathematics is one of the compulsory subjects that students must offer in senior secondary school, not minding whether such students are in science, commercial, arts or social science class. In secondary school curriculum according to National Policy on Education (2004), there are core subjects as well as electives that students must offer. These are English Language, one of the Nigerian Languages (i.e. Hausa, Igbo and Yoruba) Mathematics, one of Physics, Chemistry or Biology; one of Literature in English, History or Geography and Agriculture or a vocational subject. Also, there is a list of subjects tagged electives from which students have to offer three. These include Economics, Government, Commerce, Chemistry, and Health Science. The students' anticipated career will determine which of the electives to offer. In summary, there are compulsory and elective subjects that students do offer because of their status in the curriculum, not minding whether they are in science, commercial, arts or social science class. These subjects are Mathematics, English Language, Biology, one Nigerian Language and Economics. In addition, students are expected to register for three or four additional subjects making a total of eight or nine subjects. To further their studies in institutions of higher learning especially in University, students are expected to have credit in five subjects. Credit pass in Mathematics is also required for students offering science and social science courses. This makes Mathematics one of the essential subjects for students' advancement.

The significance of Mathematics in producing versatile and resourceful graduates that are needed for economic development cannot be over-emphasized. This is why Setidisho (1996) affirmed that Mathematics is a fundamental science that is necessary for understanding of most other fields in education. He stressed further that, it is glaring that no other subject forms such a strong force among the various branches of science. The Science Teachers Association of Nigeria (1992) referred to Mathematics as the central intellectual discipline of the technology societies. In his submission, Odusoro (2002) affirmed that the knowledge of science remains superficial without Mathematics. It therefore means that, the position of Mathematics in secondary school curriculum in Nigeria is important for scientific development. However, it is disheartening that research and data from National Examination Bodies like West African Examinations Council (WAEC) have shown a consistent poor performance in this subject.

Majority of secondary school students often dread and show negative attitude towards Mathematics (Awofala, 2000) and the trends of their achievement in the senior secondary school certificate examination is also a source of worry to the stakeholders. For instance, the percentage credit pass of students in May/ June WAEC Mathematics between 2004 and 2007 is a concern as indicated on table 1.

Table1: Students' Achievement in May/June Senior Secondary School Examination (WAEC) 2004-2007

Year	Total Number of Candidates	Credit A1-C6 %	Pass D7-E8 %	Fail F9 %	Absent %
2004	1019524	33.97	28.16	34.47	3.4
2005	1054853	38.20	25.36	34.41	2.03
2006	1149277	41.12	31.09	24.95	2.84
2007	1249028	46.75	26.75	24.24	2.26

Source: Statistics Office WAEC, Lagos (2009)

From table 1, in 2004 when 1,019,524 enrolled for Mathematics, 33.97% had credit pass (i.e A1-C6), 28.16% had ordinary pass (i.e. D7-E8), 34.47% had F9 while 3.4% were absent. From this result, it shows that only 33.97% of the enrolled candidates have the opportunity of furthering their education provided they also have credit passes in four other relevant subjects, including English language. In 2005, from 1,054,853 candidates that enrolled, 38.20% had credit pass, 25.36% had ordinary pass i.e between D7 and E8, 34.41% had F9 while 2.03% candidates were absent. Further, in 2006, 41.12% had between A1- and C6, 31.09% had between D7 and E8, while 24.95% failed. Finally, in 2007, 1,249,028 candidates enrolled, 46.75% had credit pass, 26.75% had ordinary pass, 24.24% failed while 2.26% absent from the examination. Though there is a steady increase in the percentage of students with credit pass, the conclusion drawn from students' achievement in Mathematics between 2004 and 2007 is that, more than 50% of students enrolled had below credit pass i.e. A1-C6. This is a source of worry to stakeholders.

Scholars have observed the fact that students' academic achievement is an output of educational system which cannot be examined in isolation of the inputs and process. Therefore, IBRD/World Bank (1999) asserted that good quality of education requires efficient systems that would provide supportive learning environment, motivated staff with

mastery of their subject matter, adequate access to resources, and students who are healthy and ready to learn. In the same vein, Obanya Okpala (1984) submitted that, it is only a combination of quality inputs and quality processes that can produce quality outcomes. Concerted efforts have been made at investigating trends of students' achievement in Mathematics as well as factors responsible for the level of their achievement.

Some of the reasons attributed to the observed poor achievement in Mathematics as submitted by scholars include; shortage of qualified Mathematics teachers (Ohuche, 1989), poor facilities, equipment and instructional materials for effective teaching (Akpan, 1987 and Odogwu, 1994), use of traditional chalk and talk methods (Oshibodu, 1988, Edwards & Knight, 1994), large pupils to teacher ratio (Alele-Williams, 1988) and mathematics phobia/fright (Georgewill, 1990), limited background preparation in Mathematics, lack of Mathematics teaching equipment and materials, fright and anxiety, low level of interest and some government policy (Abimbade, 1995), lack of problem solving abilities (Abimbade, 1997), self-concept and achievement motivation (Akinsola, 1994).

Good physical and mental health of school students is essential if they are to fully participate in education services being offered and if they are to concentrate and learn while in school. There is growing evidence that regular physical activity enhances learning and school achievement. Physical activity fuels the brain with oxygen, enhances connections between nerves and assists in memory. Children who participate in daily activity have shown superior academic performance and better attitudes towards school (Dwyer, Blizzard and Dean, 1996). This means that, schools with effective health services have better chances of achieving high academic excellence in their students. Not only that, availability of sports facilities which facilitate regular physical activity is also germane to effective learning.

School counselling services serve a vital role in maximizing students' achievement. Effective counselling services are important to the school climate and a crucial element in improving student achievement (American School Counselor Association, ASCA, 2008). A lot of studies have revealed a close link between school counselling and students' academic achievement. For instance, House and Martin (1998) and, Lee and Watz 1998 discovered that, school-counselling service through the counsellors has great effect on academic achievement of students.

School leadership is one of the school-based quality factors that have to be reckoned with in students' achievement. Leadership is the process of influencing the activities of an organized group towards goal setting and goal achievement. It is the ability to get things done with the assistance of other people in the institution (Adesina, 1980). It is a mechanism for directive coordination, which leads to goal achievement in an organisation (Atanda and Lameed, 2006). A cursory examination of the literature on school effectiveness reveals that while there are some differences of approach, the active leadership of the principal is regarded as essential to school improvement in general and the most essential ingredient of educational reform (Purkey and Smith, 198). To be regarded as effective, the principal being the educational leader must ensure that other effective factors are put in place. Obadara (2005) discovered that transformational and transactional leadership styles contributed significantly to academic performance of secondary school students ($R = 0.712, P < 0.05$) and ($R = 0.799, P < 0.05$), respectively.

Supervision is a quality assurance mechanism in education. This could be carried out within the school by the head of department, vice principal or the principal. The Ministry of Education also supervises the schools in their domain so as to achieve the school goal. Kose

(2007) stressed that instructional supervision is critical for the effective teaching and learning processes. It is one of the factors that influence students' performance in schools (Pansiri and Dambe, 2005). It means that instructional supervision is meant to improve instruction and learning outcome. Atanda (2002) also found positive relationship between supervision of instruction and school quality ($r = 0.766$). He also confirmed that supervision in both private and secondary schools does not differ.

The place of instructional materials in facilitating teaching and learning has been a major concern of researchers in recent time. Apparently because of this concern, different researches have been carried out on the effective use of different media in facilitating teaching and learning. Consequently, researchers like Abimbade (1997) and Lasisi (2004) agreed that no matter the method or strategies chosen to be effective, there is need to make use of appropriate instructional materials in facilitating learning.

Studies have established significant relationship between library and students' academic performance. For instance, Keith (2004) in his study found that the size of a library media programme as indicated by the size of its staff and collection is the best school predictor of academic achievement of students. In addition, the instructional role of the library media specialist shapes the collection and in turn academic achievement. Finally, the degree of collaboration between library media specialist and classroom teacher is affected by the ratio of teachers to pupils. In a related study, Waldman (2003) discovered that students visit library for different purpose. This purpose therefore will have strong influence on their performance. In one of his research questions that what did they do at library? 80% reported studying, 38% to do research, 33% to sleep, 30% to socialize, 24% to use the library's electronic resources, 22% to check the books out and 21% to e-mail or chat. He concluded that, even though some of these areas overlap (research and use of electronic resources, for example) and students could pick more than an option, it is clear that these students are mostly using the library as a place, not to make use of the library resources or services.

From fore going, the empirical studies have established that there are a number of factors found within the school which could influence students' achievement in Mathematics in secondary schools. It is against this background that the study investigated the influence of school-based quality factors (school leadership, quality of instruction, school library, supervision of instruction, counselling services, health services, convenience, instructional materials and sports facilities) on students' academic achievement in Senior Secondary School Certificate Examination in Nigeria with special reference to Mathematics

Hypotheses

The following hypotheses were formulated to guide the study:

- Ho₁ There is no significant relationship between school-based quality factors and students' academic achievement in Mathematics in South-West and North Central, Nigeria.
- Ho₂ School-based quality factors have no significant joint effect on students' academic achievement in Mathematics in public senior secondary schools in South-West and North Central, Nigeria.
- Ho₃ School-based quality factors have no significant relative contribution to students' academic achievement in Mathematics in public senior secondary schools in South-West and North Central, Nigeria.

Research Methodology

The study adopted descriptive survey research design of the *ex-post facto* type. The target population of the study covered principals and teachers in all the public senior secondary schools in South West (i.e. Lagos, Ogun, Oyo, Ondo, Osun and Ekiti States) and North Central i.e. Benue, Kogi, Kwara, Nazarawa, Niger, Plateau States and Federal Capital Territory States) geo-political zones. However, the target population of the study covered principals and teachers in all the public senior secondary schools in Oyo and Ogun States (South West, Nigeria), Kwara and Kogi States (North Central, Nigeria). The total number of schools in the four states as at the time of data collection was 1,684.

The sample for the study was selected through multi-stage sampling procedure. The first stage was sampling of geo-political zones. The total number of schools sampled was 507. The principals of all the selected schools (507) participated in the study while 507 Mathematics teachers were sampled through purposeful sampling technique (that is, teachers that taught Senior Secondary School III whose the results were used). Both teachers and principals were 1,014.

Two research instruments were used for data collection: School-Based Quality Factors Inventory (SQIFI) meant for the school principals and School – Based Quality Factor Questionnaire (SQIFQ) completed by the Mathematics teachers were face and content validated. The reliability coefficient for School-Based Quality Factors Inventory (SQFI) was 0.89 and that for the School Quality Factor Questionnaire was 0.92. The data collected were analysed with multiple regression and hypotheses were considered at 0.05 level of significance.

Results of Hypotheses Testing

In this section of the paper we present the analysis of the results of the hypotheses.

The Results of Testing H1

Table 2: Pattern of Relationship Between School Factors (Independent Variables) and Students' Achievement in Mathematics in South-West and North-Central, Nigeria

Independent variables	Performance in Mathematics		Remark
	R	Sig	
Supervision of Instruction	.024	.308	Not significant
School Leadership	.067	.081	Not significant
Quality of Instruction	.005	.462	Not significant
Guidance and Conselling	.060	.105	Not significant
Health service	0.06	.120	Not significant
School library	0.06	.305	Not significant
Conveniencences(toilet)	.107	.013	Significant
Instructional materials	.116	.008	Significant
Sports facilities	.032	.225	Not significant

Table 2 shows pattern of relationship between school based quality improvement

factors and student academic achievement in Mathematics. Out of the nine independent variables only two have significant positive relationship with students' academic achievement in Mathematics. These are conveniences (toilet) ($r = .107$; $P < 0.05$) and instructional materials ($r = .116$; $P < 0.05$).

The Results of Testing H2

Table 3: Composite Effect of Independent Variables on Students' Achievement in Mathematics

Multiple R = .191 R Square = .037					
Adjusted R Square = .016 Standard Error = 50.52					
Analysis of variance					
Source of Variation	SS	Df	MS	F	P
Regression	40743.461	9	4527.051	1.774	0.071
Residual	1072012	420	2552.409		
Total	1112755	429			

From table 3 coefficient of determination (Adjusted R^2) = 0.016 and this gives proportion of variance (Adjusted $R^2 \times 100$) = 1.6%. This implies that the independent variables accounted for 1.6% of the variance in the dependent variable. The joint effect of school based quality improvement factors is not significant on the students' achievement in Mathematics in Nigeria ($F=1.774$; $df(9,420)$; $P>0.05$)

The Results of Testing H3

Table 4: Relative Contribution of School-Based Quality Factors on Students' Achievement in Mathematics in South-West and North-Central, Nigeria

Model	Unstandardized Coefficient		Standardized Coefficient Beta B	T	Sig.
	β	Std. Error			
Constant	-26.444	21.502		-1.230	.219
Supervision of instruction	-.757	.692	-.065	-1.094	.275
School leadership	1.226	.680	.103	1.804	.072
Quality of Instruction	-9.76E - 02	.598	.010	-.163	.870
Guidance and Counselling	2.425	2.693	.062	.900	.368
Health Service	-2.729	2.662	-.079	-1.025	.306
School Library	0.831	1.591	.033	.522	.602
Conveniences	6.630	2.869	.130	2.381	.018
Instructional materials	5.696	2.306	.134	2.470	.014
Sports facilities	-1.213	1.740	-.045	-.697	.486

Table 4 shows the relative contribution of independent variables on dependent variable. Out of the nine variables, the two variables that contributed significantly to student's achievement in Mathematics are conveniences and instructional materials ($\beta = 0.130$, $t = 2.381$, $P < 0.05$), ($\beta = 0.134$, $t = 2.470$; $P < 0.05$) respectively.

Discussion of Results

The relationship between students' achievement in Mathematics and quality of instruction was not significant. In the same manner, its contribution to students' achievement in Mathematics was insignificant. This explains that teachers' quality of instruction alone could not enhance students' achievement. There are other factors responsible. Further, the relationships between counselling services and students' academic achievement in Mathematics was not significant. Not only that, its contribution to Mathematics was not significant. This might be attributed to inadequacies in school counselling offices or near non-availability of these offices, counselling personnel, counselling tools, in the counselling offices for students as observed during the data collection. This study did not corroborate the previous findings that have revealed a close link between school counselling services and students' academic achievement (Capuzzi, 1998; House and Martin, 1998; Lee and Watz, 1998; and Brigman and Campbell, 2003). This could be as a result of different location of the studies, time lag, and a change in societal values.

Supervision did not have positive significant relationship between students' achievement in Mathematics. The contribution made to students' academic achievement in Mathematics was not significant. The reason for insignificant relationships and little or no contribution of supervision of instruction to students' achievement in Mathematics may be attributed to the less emphasis on instructional improvement of students by the principals in the course of their supervisory exercise.

Conveniences have relationship with students' academic achievement in Mathematics and contributed significantly. This emphasizes the importance of conveniences in school system. It is natural that teachers and students have to ease themselves. Their concentration could be affected in teaching-learning process if adequate attention is not given to this facility by concerned stakeholders.

Further, the study showed the importance and significant role played by instructional materials on students' achievement, especially in Mathematics. They have positive influence on achievement in Mathematics. This explains why a subject like Mathematics will require real objects that can convert topics that seem imaginary to concrete for students' understanding. This establishes the conclusion made by Talmadge and Eash (1976) about four decades ago that instructional materials influence student achievement, use of process skills, and other learning outcomes. This finding consolidates previous research that revealed positive influence of instructional media on students' performance (Adedokun, 2002).

The finding of this study affirmed that all the nine school-based quality factors identified accounted for little proportion of students' achievement in Mathematics. Thus, the joint effect was not significant. This means that these factors are not good predictors of students' achievement in Mathematics. One of the reasons that could be adduced to this is inadequacy of most of these variables as observed in the field work and ineffectiveness of some of the factors (like leadership and supervision) as confirmed by some teachers. In addition, there might be other factors or variables within or outside the school premises that are stronger than those identified in the study which could have significant influence on students' achievement in Mathematics.

Conclusion, Implications of Findings and Recommendations

The findings of the study have demonstrated that instructional materials and conveniences (toilets) are strong school-based quality factors which have the tendency of contributing significantly to students' achievement in Mathematics. Therefore, their availability and accessibility by students could result into better achievement in Mathematics and if otherwise, reverse will be the case.

The significant contribution of conveniences shows its importance in students' performance. It implies that, if it was adequate, its contribution might be higher than what was obtained from the findings. However, based on reviewed literature, its inadequacy has a serious implication on students' regularity in schools. A healthy student needs to excrete waste from his/her body. Therefore, non-availability or poor toilet facility repels students' regularity in school. Teachers and other administrative staff too cannot find such school comfortable. Teacher can keep off occasionally when his/her excretory or digestive system is mal-functioning. If this happens on the part of students, important topics missed for such day or days may not be recovered thereby constituting failure in the nearest future. While in the case of teachers, expected topics missed may not be taught again. This may form basis for students' failure since continuity of such subject's content has been broken because of the topic missed when the teacher were absent owing to non-availability of toilet facilities.

As identified by Abraham Maslow, toilet facility is one of the physiological (basic) needs. Government should ensure that schools are provided with effective and adequate toilet facilities. As it can be seen that conveniences accounted for significant contribution to student academic achievement, school authorities should sensitize parents and old students about the need for toilet and solicit for their assistance.

It is also recommended that instructional resources should be provided in schools. Instructional materials make teaching real and facilitate learners understanding. Apart from provision by government, teachers should be creative in improvising instructional materials in their different disciplines.

References

- Abimbade, A., (1995). *Mathematics method 2*. Centre for External Studies, Faculty of Education, University of Ibadan (TEE 333).
- Abimbade, A. (1999). *Principles and practice of educational technology*. Ibadan: International Publishing Ltd.
- Adedokun, J.A. (2002). Availability of learning environment resources as predictor of the level of teachers' accountability to science students' performance. *Nigerian Education Review*, 3, 11-17.
- Adesina, S. (1980). *Some aspects of school management*. Lagos: Educational Industries Nigeria Limited.
- Akinsola, M.K. (1994). Comparative effects of mastery learning and enhanced mastery learning strategies on students' achievement and self concept in mathematics. (Unpublished Ph.D Thesis). University of Ibadan.
- Akpan, A.A. (1987). *Correlates of mathematical problem-solving ability among secondary school students*. Unpublished Ph.D Thesis, University of Ibadan, Ibadan.
- Allele-Williams, G. (1988). Keynote address delivered at the Silver Jubilee meeting of Mathematics Association of Nigeria (MAN) Sept. 1982, *Abacus* 18(1).

- American School Counsellor Association, (2008). *Effectiveness of school counselling*. [http://www.schoolcounselor.org/content.asp?retrieved 5/23/08](http://www.schoolcounselor.org/content.asp?retrieved%205/23/08).
- Atanda A.I. (2002). *Supervision as a correlate of effective performance of teachers in secondary schools in Ibarapa East Local Government Area of Oyo State, Nigeria*. M.ED Thesis in the Department of Educational Management, University of Ibadan.
- Atanda, A.I & W.O. Lameed. (2006). *Fundamentals of school organisation and classroom management*. Ibadan: Awemark Industrial Printers.
- Awofala, A.O.A. (2000). *The status of mathematics teaching and learning in primary school at the year 2000*. Unpublished B.Ed Project in Teacher Education, University of Ibadan.
- Brigman, G. & Campbell, C. (2003). Helping students improve academic achievement and school success behaviour. *Professional School Counselling*, 7: 91-98.
- Capuzzi, D. (1998). Social action: A mandate for counsellor. Edited by C.C. Lee and G.R. Walz. Alexandria VA: *American Counselling Association*, 99 – 116.
- Dwyer, T., L. Blizzard & K. Dean. (1996). Physical activity and performance in children. *Nutrition Review*, 54.4: 527-531.
- Edwards, R. & Knight, P. (1994). *Effective early years education: Teaching young children*. Buckingham: Open University Press.
- Federal Republic of Nigeria, (2004). National Policy on Education, Abuja: NERDC.
- Georgewill, J.W. (1990). *Causes of poor achievement in WAEC Mathematics examination in Rivers State secondary schools, Nigeria*. *International Journal of Mathematical Education in Science and Technology*, 21:3
- House, R.M. & Martin, P. J. (1998). Advocating for better features for all students: A new vision for school counsellors. *Education*, 284 – 291.
- Keith, C.L. (1993). *School librarians and student performance*. <http://www.library.queen.edu.au/inforef/library> Retrieved 19/08.07.
- Kose, B.W. (2007). *Instructional supervision: University of Illinois at Urbana Champaign, College of Education: Department of educational organisation and leadership*. Retrieved from <http://www.ed.uiuc.edu/eo/frp/bkose>
- Lasis, S.O. (2001). *Effects of three instructional media in students' teacher learning outcome: Selected teaching skills*. Unpublished M.Ed Dissertation of the University of Ibadan, Ibadan.
- Lee, C.C. & Waltz, G. R. (1998). (Eds.). *Social action: A mandate for school counselors*. Alexandria, VA: American Counseling Association.
- Obadara, O.E. (2005). *Perceived full-range leadership, teacher factors and the academic performance of secondary schools in ogun state, Nigeria*. A Ph.D. thesis submitted to the Department of Educational Management, University of Ibadan, Ibadan, Nigeria.
- Obanya, P.A.I. (2002). Sampling plan for the I.E.A study of written composition in Nigeria. WCS/ICEE/NY 7001pp12
- Odogwu, H.N. (1994). Primary school teachers and the teaching of time concept in schools. *Education Today* 7:2
- Oduoro, U.I. (2002). *The relative effect of computer and text-assisted programmed instruction on students learning outcomes in Mathematics*. Unpublished Ph.D. thesis, University of Ibadan
- Ohuche, R.O. (1989). Recent attempts at Mathematics Curriculum renewal in English speaking West Africa. *Abacus*, 12:11
- Oshibodu, B.M., (1988). Mathematics at primary level. *Abacus* 18.1
- Pansiri, N.O & Dambe, M. R. (2005). *Instructional leadership for improving commitment to basic education for the remote area dwellers in Botswana*. Faculty of Education. University of Botswana.

- Purkey, S. & Smith, M. (1983). Effective schools: A review. *Elementary School Journal*, 83: 335-351.
- Setidisho, N.O.H. (1996). Aims of teaching mathematics. *West African Journal of Education* 4. 3:251-260
- STAN. (1992). Women in Science, technology and mathematics: The Nigerian experience. *Science Teachers Association of Nigeria Position paper No. 2*, Ibadan.
- Talmadge, H. & Eash, M.J. (1976). Curriculum, instruction, and materials. In Penelope, L .P Herbert, J. W. and Berkeley (Eds.). *Research on teaching concepts, findings, and implications*. McCutcheon Publishing Corporation.
- Waldman, M. (2003). Fresher's use of library electronic resources and self-efficacy. *Information Research*, 8, 2:202-234.

Adebola O. Jaiyeoba

Department of Educational Management, University of Ibadan, Ibadan, Nigeria

E-Mail: adebolajaiyeoba@yahoo.co.uk

Phone: +234-8037218010

Ademola I. Atanda

Department of Educational Management, University of Ibadan, Ibadan, Nigeria

E-Mail: dermyhblessing@yahoo.com

Phone: +234-8024323231