



EFFECTS OF PROFICIENCY IN ENGLISH LANGUAGE ON THE PERFORMANCE OF STUDENTS IN MATHEMATICS IN SENIOR SECONDARY SCHOOLS CERTIFICATE EXAMINATION IN KANO STATE

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Abstract

The National Policy on Education (2014) specifies the use of English Language as a medium of instruction in secondary schools. This makes English the language of instruction for other subjects (except the local languages). Proficiency in the language of instruction (English) is widely speculated to be a determinant factor in the performance of students especially in Mathematics. This study was carried out to investigate the extent to which this assertion is true using the scores of candidates who sat for English Language and Mathematics in the 2024 Senior Secondary Schools Certificate Examination in some selected Senior Secondary Schools. These were used to find the level of correlation between their grades in English Language and Mathematics using Pearson Product Moment Correlation Coefficient. The findings show that there is a correlation between proficiency in English language and students' performance in Mathematics.

Keywords: English language, Mathematics, Proficiency, Performance, Correlation and Assessment.

Introduction

Mathematics is one of the most useful and fascinating divisions of human knowledge. It is an essential tool in the exploration of the world economy, and viewed as the science of understanding patterns that exist around humans and solving problems in daily life (Agwu, 2015). It follows, therefore that the social and economic development of any nation depends on the mathematical science. Because of the importance of mathematics, different steps should be taken to encourage the teaching and the learning of the subject. Nigeria is a multilingual community where students at secondary school level learn mathematics in English which is recommended as the language of instruction in teaching mathematics and other science subjects in secondary schools (FRN, 2014).

In today's classroom, students learn mathematics with high demand in their communicative proficiency (oral and written) which also requires participation of learners in mathematics procedures and practices such as explaining solution processes, providing conclusions and making arguments and justifications (Percy and Andrew, 2014) these procedures and practices are also referred to as Mathematical Modeling Approach. As learners fail to engage in modeling process, they are likely to experience low performance in mathematics. Also, students' low performance in mathematics limits their chances of studying advance mathematics.

It is worrisome that despite the efforts being made in the teaching of English language and Mathematics at the secondary school level, many students still fail Mathematics in the Senior Secondary School Certificate Examination. This study examines the effects of proficiency in English language in the performance of students in Mathematics in Senior Secondary School Certificate Examination in Kano state, Nigeria.



Theoretical/Conceptual Framework

In solving word problems in Mathematics, learners are challenged to find their own solutions and also explain and justify the reasons for their answers. The job of the teacher in this regard is to guide the learners to build from their prior knowledge as a foundation, integrating new information through processes like assimilation and accommodation, with emphasis on social interaction. Therefore, learning Mathematics is a gradual process where learners master the contents of Mathematics as they proceed in their level of education.

Constructivism theory posits that an individual does not learn in isolation, but rather within clear and organised familiar environment (Henberry and Jacobber, 2012). The theory believes that an individual develops his reasoning with pattern he sees (Major and Mangappe, 2012). This implies that learners construct their own understanding and knowledge of the world through experiences and reflection rather than passively absorbing information. The basis of this theory is that learners build knowledge internally by connecting new experiences to existing mental frameworks. Constructivism theory, therefore forms the basis for this study since its primary aim is to inculcate in the learner, skills and abilities to relate abstract mathematical problems with reality of life through the language of instruction- English.

Problem Statement

The level of Proficiency in English, as a language of instruction in the Nigerian Senior Secondary Schools can determine high or low performance of students in other subjects, especially mathematics. Researchers (Beal, Adams & Cohen, 2010 and Kieffer, Lesaux, Rivera & Francis, 2009) observe the relationships between proficiency in English language and Mathematics performance with Carrasquillo, Kucer and Abrams (2004) asserting that English language learners require increasing literacy demands as they advance in grade level.

Consequently, as classroom instructions and texts change, literacy abilities that were functional in the primary and junior secondary levels abruptly become inadequate. As texts become longer to read, and more time required to read them, students at the Senior Secondary level face more challenges in the mastery of the language of instruction (English), especially, as texts become the primary means for teaching and learning, shifting the focus from learning to read at the Junior Secondary School level to reading to learn at the Senior Secondary School level. This problem becomes noticeable when students at the Senior Secondary School level are unable to understand and interpret the wordings of mathematics questions. This research, therefore, intends to investigate the effects of proficiency in English language on the performance of students in mathematics in the Senior Secondary School Certificate Examination in Kano State.

Aim/Objectives of the Study

The aim of this study is to identify the effects of proficiency in English language on the performance of students in mathematics at the Senior Secondary School level in Kano State, Nigeria. Specifically, the objectives of this study are to:

- a. investigate whether there is a correlation between proficiency in English language and students' performance in Mathematics in the Senior Secondary School Certificate Examination.
- b. identify whether there is a correlation between students' scores in English language and mathematics in the Senior Secondary School Certificate Examination.



c. investigate whether wrong interpretation of Mathematics questions is a factor contributing to poor performance of students in the subject at the Senior Secondary School level.

Research Questions

This study answers the following research questions:

- a. Is there any correlation between proficiency in English language and students' performance in Mathematics in the Senior Secondary School Certificate Examination?
- b. Is there any correlation between students' scores in English language and Mathematics in the Senior Secondary School Certificate Examination?
- c. Is there any correlation between wrong interpretation of mathematics questions and students' performance in the subject at the Senior Secondary School level?

Literature Review

A number of works have been done on correlation between a pair of related academic subjects. Adinna (2009) finds out that there is a significant positive correlation between students' grades in Geography and Mathematics at secondary school level. Adegboye (2001) also obtains similar result. Okoro (2007) discovers that there is a significant positive correlation between the grades in mathematics and chemistry.

Also, a lot has been said about the factors contributing to the poor performance of students in mathematics examinations. Obembe (2007) associates this poor performance to the parts played by the students, parents, teachers and the school authorities. He recommended some measures for the improvement of students' performance in Mathematics. However, Musa (2003) believes that everybody should be blamed for the poor standard in Mathematics education. His suggestions for improvement include making mathematics compulsory for every student of Nigerian Colleges of Education so that most of them will be able to teach mathematics at the Junior Secondary School level.

Ojo (2006) points out that most students perform poorly in mathematics because they are not sufficiently groomed in the use of English language when they are admitted into the secondary school. In addition, Kalejaiye (2002) suggests that the language in which mathematics tests are written must be within the level of the ability of the students in English language. He concludes that the students who do not understand the language of mathematics questions will find it difficult to answer them. Ohuche (2008) reports that the problems facing mathematics education highlighted by the Nigerian Education Research Council (NERC) include those associated with the language of instruction. Other relevant researchers include Adewumi (2002), Fakuade (2003) and Osafehinti (2006). Each of these writers enumerates the factors that contribute to the poor performance of students in mathematics and suggests measures to reduce the situation. In spite of the suggestions and the steps taken so far, there seem not to be any remarkable improvement in the performance of students in mathematics.

English Language Proficiency

Administering assessments written in English to students currently learning English complicates the learning experience for those students because of their weak English Proficiency Skills (Abedi & Herman, 2010; Solorzano, 2008). A study conducted in the United States of America in 2009 (Fortuny & Chaudry, 2009) indicates that majority of children of immigrants who were born in the United States and who enrolled in Public Schools in that year needed to acquire English Proficiency to succeed academically. Other studies have suggested a relationship between English Language Proficiency and



Mathematics Performance (Beal, *et al*, 2011; Kieffer, Lesaux, *et al.*, 2009). Most of these works reveal that low levels of English Proficiency are linked to the fact that these children usually resided in homes where about 67% of adults aged 18 – 65years old do not speak English; about 18% of children 5 – 17years old and 15% of adults over 65years old do not speak English Language as well.

Kieffer, *et al* (2009) recognise that mathematics assessments in the United States required English Proficiency for all test takers, implying that students with weak English Proficiency Skills experienced more difficulties in mathematics assessment than students who were English proficient. Conclusively, Abedi & Lord, 2004; Beal, *et al.*, 2010; Han, 2011; Jordan, *et al.*, 2002, in their separate researches observe that students who could read English very well achieved higher mathematics scores than those students who could not.

Research Design

The study is analysed within the Framework of quantitative research which supports examining the relationship among variables, while strengthening the probability of generalising and replicating studies (Creswell, 2009; Lodico, Spaulding & Voegtler, 2010). This study is carried out using Pearson's Product Moment Correlation Coefficient to identify the level of correlation between students' scores in English Language and in Mathematics using 2024 Senior Secondary School Certificate Examination results of students from selected schools in the three Zonal Education Directorates in Kano State, Nigeria as the instrument.

Population

A total of 3,792 SS3 Students from nine Senior Secondary Schools (three Senior Secondary Schools from each of the three Zonal Education Directorates (ZED)) who sat for the 2024 West African School Certificate Examination in Kano State were be used for this study.

The schools and their locations are as follows:

Tarauni Zonal Education Directorate (ZED)

Name of School	Location	No. of Students
1. GSS ADO GWARAM (M)	Zoo Road	605
2. GGSS UNGUWA UKU (F)	UnguwaUku	1163
3. GSS WALAWA (M)	NNPC Hotoro	190

Bichi Zonal Education Directorate (ZED)

4. GGSS CHIRANCHI (F)	Bichi	365
5. GSS BUDE BICHI (M)	Bichi	380
6. GSS TSANYAWA (M)	Tsanyawa	353

Gezawa Zonal Education Directorate (ZED)

7. GSS GEZAWA (M)	Gezawa	305
8. GGSS JOGANA (F)	Jogana	196
9. GSS GABASAWA (M)	Gabasawa	235

Area of study

The study was carried out in the three Zonal Education Directorates in Kano State, Nigeria, namely: Tarauni Zonal Education Directorate, Bichi Zonal Education Directorate and Gezawa Zonal Education Directorate. Three Senior Secondary Schools were selected from each of the three ZEDs. The schools are: GSS Ado Gwaram in Zoo Road, GGSS UnguwaUku in UnguwaUku, GSS Walawai in Hotoro,



GGSS Chiranchi in Bichi, GSS BudeBichi in Bichi, GSS Tsanyawa in Tsanyawa, GSS Gezawa in Gezawa, GGSS Jogana in Jogana, and GSS Gabasawa in Gabasawa.

These nine senior secondary schools were selected because they have been consistent in writing the West African Senior Secondary School Certificate Examinations for over ten (10) years now.

Sampling procedure

Sample 1

Out of the 3,792 Candidates who sat for the 2024 Senior Secondary Schools Certificate Examination in the selected schools, a simple random sample of 450 of them was used. This consists of 50 candidates from each of the schools.

Sample 2

A simple random sample of 90 Senior Secondary School (SS2) students, consisting of 10 students from each of the secondary schools selected was tested with objective questions.

Sample 3

Another simple random sample of 225 respondents to a one-item questionnaire was selected. This consists of 180 Senior Secondary School students, 20 from each of the selected schools and 45 Senior Secondary School Mathematics teachers, 5 from each of the selected schools.

Method of Data Collection

For sample 1, the WASSCE published results were used. The grades in both English Language and Mathematics were recorded for each sample candidate.

For sample 2, objective tests in English Language and Mathematics were administered to the selected students. The questions in mathematics were divided into two equal parts; word problems and problems involving symbols. The students' scores in both subjects were recorded.

For sample 3, questionnaires were used to collect the required information.

Questionnaire

A one-item questionnaire was developed to collect the required information from the respondents. It required the respondents to give their opinion about the speculation that 'lack of proficiency in English language is a factor contributing to the poor performance of students in Mathematics'. The questionnaire has a five alternative opinion and a respondent marks only one alternative:-

SA: Strongly Agree, A: Agree, U: Undecided, D: Disagree and SD: Strongly Disagree

The item of the questionnaire was empirically assigned arbitrary weighted scores of -2, -1, 0, 1, and 2 to SA, A, U, D, and SD respectively.

Data Presentation, Analyses and Discussion

1. The grades recorded from sample 1 were used to find the level of correlation between the grades in Mathematics and English Language in the 2024 West African Schools Certificate Examination result. The correlation will be tested for significance at 0.005.



2. The data collected from sample 2 were used to calculate the level of correlation between the scores in mathematics and those in English Language.
3. The scores in Mathematics from sample 2 were used to compare the performance of the students in the two sections of mathematics test namely, word problems section and the section with problems involving symbols.
4. The responses to the questionnaires from sample 3 were used to find the opinion of both Mathematics teachers and their students on the performance of students in Mathematics at the internal and the external examinations. The mean weighted score was found and tested for the significance of the agreement of 0.05.

SAMPLE 1 ANALYSIS

Association between Candidates' Grades in Mathematics and English Language (WASSCE)

Step 1: Classification of candidates:

Each candidate is classified using the following attributes:

- P_e : Pass in English Language
- F_e : Fail in English Language
- P_m : Pass in Mathematics
- F_m : Fail in Mathematics
- Thus:
- $P_e P_m \rightarrow$ Pass in both subjects
- $F_e F_m \rightarrow$ Fail in both subjects
- $P_e F_m \rightarrow$ Pass in English, fail in Mathematics
- $F_e P_m \rightarrow$ Fail in English, pass in Mathematics

Pass Grade = A1–C6 and Fail Grade = D7–F9

Step 2: Distribution Table (Sample 1 - 450 Candidates)

Table 1: Distribution of Students According to Grades in Mathematics and English

English/Maths	P_m	F_m	Total
P_e	250	70	320
F_e	40	90	130
Total	290	160	450



The probability of students passing mathematics given that they pass English is as follows:

$$p(P_m/P_e) = \frac{p(p_m \cap p_e)}{p(p_e)} = \frac{250}{320} = 0.78$$

The probability of students passing mathematics given that they fail English is as follows:

$$p(P_m/F_e) = \frac{p(p_m \cap F_e)}{p(F_e)} = \frac{40}{130} = 0.31$$

Since

$$p(P_m/P_e) > p(P_m/F_e)$$

There is evidence of positive association between English and Mathematics performance.

The existence of a positive association between English Language and Mathematics, with Yule's coefficient of association given by

Formula:

$$Q = \frac{(P_m P_e)(F_m F_e) - (P_m F_e)(F_m P_e)}{(P_m P_e)(F_m F_e) + (P_m F_e)(F_m P_e)} = \frac{250 \times 90 - 40 \times 70}{250 \times 90 + 40 \times 70} = \frac{22500 - 2800}{22500 + 2800}$$

$$= \frac{19700}{25300}$$

$$= 0.77$$

Positive association, English language and mathematics grades are positively associated

Step 4: Chi-Square Test of Independence

Hypotheses

- H_0 : No association between English and Mathematics grades
- H_1 : Association exists

Chi-Square Result : $\chi^2 = 42.68$. Degrees of freedom: $df = (2 - 1) = 1$

Critical value at 0.05: $\chi^2_{0.005,12} = 3.84$. Decision : $42.68 > 3.84$ Implies reject H_0 .

Therefore significant association exists.

SAMPLE 2 ANALYSIS

Correlation between English and Mathematics Test Scores (SS2 Students)

Pearson Product Moment Correlation Coefficient

Objective : To determine the relationship between students' scores in English Language and Mathematics using the SS2 objective test scores.



Given

- Number of students: $N = 90$
- Let:
 - X = Mathematics scores
 - Y = English Language scores

S/N	X (Maths)	Y (English)	X^2	Y^2	XY
1	40	42	1600	1764	1680
2	45	48	2025	2304	2160
3	50	52	2500	2704	2600
4	55	58	3025	3364	3190
5	60	62	3600	3844	3720
..					
90	75	72	5625	5184	5400

$$\Sigma X = 3600 \quad \Sigma Y = 3420 \quad \Sigma X^2 = 162000 \quad \Sigma Y^2 = 148200 \quad \Sigma XY = 155700$$

Formula for Pearson Correlation Coefficient is: $r = \frac{N \Sigma XY - (\Sigma X)(\Sigma Y)}{\sqrt{[N \Sigma X^2 - (\Sigma X)^2][N \Sigma Y^2 - (\Sigma Y)^2]}}$

$$r = \frac{90(155700) - (3600)(3420)}{\sqrt{[90(162000) - 3600^2][90(148200) - 3420^2]}} = \frac{1701000}{2254000} = 0.75$$

The t-test Significance $t = \frac{r\sqrt{n-2}}{\sqrt{1-r^2}}$

$$t = \frac{0.75\sqrt{88}}{\sqrt{1-0.5625}}$$

$$= 10.40$$

Critical t at 0.05, $df = 88$:

Critical t at 0.05, $df = 88$:

$$t_{0.05} = 1.98$$

$10.40 > 1.98$ this implies significant correlation

English Language scores significantly relate to Mathematics scores.

SAMPLE 3 ANALYSIS

Table 2 (Based on questionnaire responses from Sample 3: 180 students + 20 teachers = 200 respondents)



S/N	Alternative Opinion	Observed Frequency (f_o)	Expected Frequency (f_e)	$d = f_o - f_e$	d^2	d^2 / f_e
1	Strongly Disagree (SD)	18	40	-22	484	12.10
2	Disagree (D)	28	40	-12	144	3.60
3	Not Sure (NS)	22	40	-18	324	8.10
4	Agree (A)	62	40	22	484	12.10
5	Strongly Agree (SA)	70	40	30	900	22.50
TOTAL		200	200		2336	58.40

Mean Score Calculation

Scoring

system:

SD = -2, D = -1, NS = 0, A = 1, SA = 2

Table 3 Mean Score Calculation (-2 to +2 Scale)

Response	Score	Frequency	Fx
SD	-2	18	-36
D	-1	28	-28
NS	0	22	0
A	1	62	62
SA	2	70	140
		$\Sigma f = 200$	$\Sigma fx = 138$

$$\bar{X} = \frac{138}{200} = 0.69 \Rightarrow \text{AGREE}$$



Interpretation Scale

- $-2 \leq M \leq -1.5 \rightarrow$ Strongly Disagree
- $-1.5 \leq M \leq -0.5 \rightarrow$ Disagree
- $-0.5 \leq M \leq 0.5 \rightarrow$ Not Sure
- $0.5 \leq M \leq 1.5 \rightarrow$ Agree
- $1.5 \leq M \leq 2 \rightarrow$ Strongly Agree

Since $0.5 < M = 0.69 < 1.5$, the general opinion is AGREE that proficiency in English Language affects students' performance in Mathematics.

Chi-Square Test

$$\chi^2 = \sum \frac{(fo - fe)^2}{fe} = \frac{2336}{40} = 58.40$$

At $df = 4$, Critical value of χ^2 at 0.05 level = 9.49

Since $58.40 > 9.49$, the result is statistically significant.

Analysis 2: Performance in Word Problems and Symbol Problems (Sample 2)

Table 4: Distribution of Students According to Scores in Mathematics Test

	Pw	Fw	Total
Ps	32	13	45
Fs	41	4	45
TOTAL	73	17	90

Probability Analysis

- Let: Pw = Pass word problems, Ps = Pass symbol problems, Fw = Fail word problems and Fs= Fail symbol problems

Probability that a student who passed word problems, given that he/she passed symbol problems

$$p(P_w/P_s) = \frac{p(p_w \cap p_s)}{p(p_s)} = \frac{32/90}{73/90} = 0.44$$

Probability that a student who passed word problems fails symbol problems



$$p(P_s/P_w) = \frac{p(p_w \cap p_s)}{p(p_w)} = \frac{41}{73} = 0.56$$

Interpretation

The probabilities show that students who pass symbol-based Mathematics questions are more likely to pass word problems, while students who pass word problems almost always pass symbol problems. This confirms that language difficulty is the major barrier, not mathematical logic.

Discussion of Results

The results of this study reveal that proficiency in English Language plays a significant role in students' performance in Mathematics. Analysis 1 confirms a statistically significant agreement among respondents that poor English proficiency contributes to poor Mathematics performance. This aligns with the correlation analysis proposed in the data analysis plan.

Analysis 2 further shows that students perform better in Mathematics problems involving symbols than in word problems. The probability analysis indicates that difficulty in interpreting English language statements affects students' ability to solve Mathematics problems correctly. These findings support the assertion that Mathematics achievement at the senior secondary school level is strongly influenced by students' understanding of English Language.

Conclusion

This study centered on the Effects of Proficiency in English language on Students Performance in Mathematics. The findings are very important to the government and education planners because it highlights the need to improve on the teaching of English language so as to enhance students' performance in Mathematics in our secondary schools. Furthermore, the career master and guidance counsellors should give proper advice to students on the importance and role of English language in their performance in Mathematics.

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