

Enhancing the Learning of Mathematics in the English Language Classroom in Nigerian Secondary Schools

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Abstract

A central dynamic of pedagogical change is the pursuit of modern and improved response to educational challenges. A majority of secondary school students regard mathematics as difficult for its intricacy. The outcome of this is mirrored in their graded scores in internal and external examinations. One repelling factor is that mathematics is usually presented as a subject that is rigid to calculations and symbols without any bearing or rapport with textual materials. With the current global embrace of interdisciplinary approach and the shift from STEM to STEAM, this study examined the possibility of using the English Language classroom to enhance the learning of mathematics in our secondary schools using Ifo Local Government Area of Ogun State as the study population. Data collected from 200 teachers comprising teachers of English Language, Mathematics and science subjects were analysed using the chi square statistics and the descriptive survey method. Findings show that the English Language classroom can be of immense help in the learning of mathematics leaning on textual materials in various lessons. Recommendations include an action plan by secondary school education policy makers and collaboration between teachers of English Language and teachers of Mathematics.

Keywords: English Language, Mathematics learning, enhancement, interdisciplinary approach, STEAM

Introduction

Secondary school education is the interface between primary school education and tertiary school education. It serves as the communication door and the bridge that connects the foundation and the roofing of the educational structure. For individual students, it is at this level and stage that the shortcomings of the primary school are identified and worked upon for corrections or the gains of the primary school are consolidated and built upon. The crucial position of secondary school education is amplified by the impact it will eventually have on the pursuit of higher education which is the gateway to the career disposition of the individual.

In Nigeria, one particular subject that is generally seen as difficult for students is mathematics. Beyond the shores of Nigeria, the situation is similar. Fleming (2019) writes about a poll conducted by Gallup in 2005 on school subjects that students considered to be most difficult, mathematics came out on top of the difficulty chart. The writer claims that mathematics is seen as

a subject saturated with theorems and workings which all revolve round juggling of figures and symbols. It is asserted that one thing that is usually overlooked is that these theorems and workings have their roots in some theories. Inadequate knowledge of these theories will hinder the acquisition of adequate knowledge needed for the necessary execution of the theorems and the workings.

In today's era of creativity and interdisciplinary approach coupled with the global shift from Science, Technology, Engineering and Mathematics (STEM) to Science, Technology, Engineering, Arts and Mathematics (STEAM), it is believed that the English Language classroom can be used to enhance the learning of mathematics. It can be used to make mathematics attractive with less tension to the students by making it to serve or act as a sort of scaffolding for the Mathematics class. American National Day Nurseries Association (2019) states that all children can be successful with mathematics if they are given the opportunities to understand it in

a way that makes sense to them.

Talking about descriptive mathematics, Delaney (2000) declares that the primary use of mathematics is description as more work will go into the description of a problem than the actual solution. It is included that most mathematics classes emphasize problem solving, giving students an unbalanced view of the subject, adding that this alienates students who have strong verbal skills than problem solving skills. It is also expressed that the goal of descriptive mathematics is to encourage students to develop a strong mathematical vocabulary in conjunction with their problem solving skills.

Some may begin to wonder how the learning of mathematics can be enhanced in the English Language classroom. The theorems and the workings are still for the Mathematics classroom, that is why the emphasis is on enhancing the learning and not the teaching of mathematics, but mathematical terms and properties can be consciously and deliberately embedded in lexis and structure, essay and vocabulary development lessons in English Language. This is why it has been said that the English Language class will serve as a scaffold for the Mathematics class. What may spring to mind again is to question the relationship between a teacher of English Language and mathematical vocabulary. It is an open fact that teachers of English Language have always maintained affinities with the vocabularies associated with other fields of human activities as part of their required professional skills. This is emphasized by English Language syllabus of the West African Examinations Council (WAEC) which demands the teaching of general vocabularies of construction, agriculture, fishing, motor vehicles, animal husbandry, science and technology among others.

Eguare (2006) submits that the teacher of English Language has to take the responsibility for equipping his students with the skills they need to pursue their studies in all other subjects either now or in the future. McGregor (1982), cited by Eguare

(2006), expounds on the need for the English Language teacher to have a wide ranging enthusiasm and imagination that give birth to ideas and interests that branch out into all other subjects that the students study in school. Ezeifeka (2010) points out that English for Specific Purposes presupposes that the language of special fields can be taught deliberately by describing the special vocabulary, syntax and discourse structure of the language.

The findings of this study will be of great benefit to secondary school education policy makers, secondary school administrators, teachers of English Language and teachers of Mathematics to recognize the ubiquity of English Language as a school subject and the possibility of engaging it in enhancing the learning of mathematics on the part of the students.. This will assist them in coming up with policy statements and activities that will prioritize the utilization of the English Language classroom to enhance the learning of mathematics. Commenting on the advantage of STEAM, Segarra et al (2018) conclude that STEAM education gives STEM and arts students the enrichment that is often not available within their set of study.

In Nigeria, three subjects are made compulsory for students in the senior secondary school. These are English Language, Mathematics and Civic Education. Of these three, English Language and Mathematics are referred to as core subjects. Many students usually fail Mathematics in both internal and external examinations, including the prominent Senior Secondary School Certificate Examination (SSSCE) conducted by both the West African Examinations Council (WAEC) and the National Examinations Council (NECO). The subject is seen as abstract and complicated. A picture of complexity is painted for it in most Mathematics classrooms as focus is commonly placed on calculations and problem solving that revolve round numbers and symbols. Little or no attention is paid to the vocabulary and the definitions that form the bases of the calculations

and symbols. A good knowledge of these vocabulary and definitions will build a formidable background for the understanding needed to gain the skills to carry out the calculations and the workings. It is in view of this that this research investigated the workability of and the reality of the employment of the English Language classroom to enhance the learning of mathematics in our secondary schools.

Research Purposes and Hypotheses

The research aims at identifying whether English Language lessons can help students in learning mathematics; and secondly whether a diversified approach to the learning of mathematics will motivate the students and improve their performance. Accordingly, the following hypotheses were postulated:

Ho 1: There is no significant role the English Language classroom can play in the learning of mathematics.

Ho 2: There is no need for a variegated approach to diversify methods for the learning of mathematics.

Literature Review

Contrary to a widespread belief that mathematics involves only working on figures and symbols, textual mathematics has been identified and explained as a complementary integral part of mathematics. Polak (2013) believes that students will be given the opportunity to be creative in their exposition if they are allowed to discover connections through mathematical essay writing. Rudd et al (2008) go a step further by specifically linking language as a tool to the teaching of mathematics. They argue that skilled teachers are able to use language to shape and guide conversations to help students further their development of mathematical concepts. They continue, while citing Moseley (2005), that Mathematical Mediated Language (MML) functions as a link between conceptually related linguistic and mathematical knowledge while emphasising the relevance and the utility of writing in mathematics.

Rinehart (2018) affirms the opportunity writing provides by learning and using relevant mathematical vocabulary, with a declaration that the type of thinking involved in the justification of a strategy or in the explanation given on an answer is quite different from the one needed to solve an equation. The writer cites Tuttle (2005) that the process of writing about a mathematics problem will itself lead to a solution, linking it to the National Council of Teachers of Mathematics (NCTM) submission that writing in mathematics can help students to consolidate their thinking as it requires them to reflect on their work and also to clarify their thoughts about the ideas developed in the lesson. Helmenstine (2019) enunciates that understanding how mathematical sentences work is helpful when teaching or learning mathematics. As explained therein, mathematical equations may be stated in words to form sentences that have nouns and verbs just like a sentence in a spoken language. According to this scholar, students often find numbers and symbols intimidating and so, putting an equation into a familiar language makes the subject more approachable. While comparing that to the translation of a foreign language into a known one, Helmenstine (2019) posits that word problems improve comprehension and increase problem-solving skills.

Lappan (2020) examined the contextual meanings in English language and concluded that for students to communicate in the language of mathematics, they have to determine meanings from contextual perspective. Writing on the impact of language on the learning of mathematics, Boulet (2007) reveals that the role that language plays in the teaching and the learning of mathematics is given some importance in current literature on mathematics education.

In the words of Anthony and Mamokgethi (2007), language plays an important role in the justification of mathematical knowledge as the use of language as a communicative tool is integral to the process of mathematical enquiry. In a similar voice, Drury (2020) writes that the contents of the

National Curriculum for Mathematics states that the quality and the variety of language that students hear and speak are key factors in the development of their mathematical vocabulary and in the presentation of mathematical justification or argument or proof.

Interdisciplinary Approach

The role of education is to facilitate learning whose result seeks the acquisition of knowledge, skills and behaviors that constructively transform the individual and the society. In the pursuit of the actualization of this acquisition, pedagogical dimensions are becoming more and more dynamic. Today, the global education community is fraternising with interdisciplinary approach. Oyero (2015) warns that responding wisely to current trends is crucial so as not to be left behind in one's specialised field of expertise. Sanyaolu (2020) writes that static approaches to teaching in a changing society impede educational objectives, underlining an urgent need to look beyond traditional approaches and examine the workability of other methods.

George and Thomaskutty (2007) zero in on mathematics. They disclose that most of the mathematics classes are boring, especially at the school level. They call for the coining of mathematics with other disciplines to create an interdisciplinary approach in teaching and learning mathematics. William and Mary (2020) report that mathematics is today applied to other disciplines such as linguistics and the social sciences.

The Faculty of Multidisciplinary Studies of the University of Ibadan (2019), proclaims that no academic discipline is an island entire in itself in contemporary times. It discloses that disciplines now overlap, borrow from, fuse into and encroach upon one another. Appleby (2019) states that students are highly motivated as they cover topics in more depth and topics will be explained from various perspectives. It is indicated in the work that students will learn by making connections

between ideas and concepts across different disciplinary boundaries. Further explanation is given that such students will be able to apply the knowledge acquired in one discipline to another discipline as a way to consolidate the learning experience.

From STEM to STEAM

In the past, much more emphasis was placed on STEM which is an acronym for Science, Technology, Engineering and Mathematics. These were then seen as straight science disciplines that need not interact with the arts. But owing to present realities and new knowledge, there is already a shift from STEM to STEAM, where the "A" stands for the Arts. The Institute for Arts Integration and STEAM (2020) unfolds STEAM education as an approach to learning that uses science, technology, engineering, the arts and mathematics as access points to guide students inquiry, dialogue and critical thinking. It explains that we have reached a point where it is imperative to facilitate learning environments that are fluid, dynamic and relevant.

Planeteers (2017) affirms that the inclusion of arts in a multidisciplinary disposition aids in the improvement of mathematics and reading scores. It also states that a research at Mississippi State University discovered that the inclusion of arts in the classroom reduced achievement gaps and provided more opportunity for problem solving. Grantham University (2020) agrees that incorporating STEM education into curricula is more effective when the arts are involved.. Similarly, Stratford School (2020), maintains that aspects of social studies, language arts and creative arts are incorporated into the school's STEAM curriculum from preschool to high school.

Methodology

The study population is delimited to secondary school teachers of English Language, Mathematics and science subjects in Ifo Local Government Area of Ogun State in Nigeria. The data analysed in this work was generated from the

responses of the respondents who made up the sample for this research. Two hundred secondary school teachers of English Language, Mathematics and science subjects were selected from Ifo Local Government Area of Ogun State as sample for this study. They were selected because they possessed similar characteristics of other secondary school teachers of English Language, Mathematics and science subjects in the local government area. Random sampling method was used.

Each of the two hypotheses was tested with a selection of a number of relevant items on the questionnaire. The questionnaire enabled the

respondents to specify their level of agreement or disagreement. The items were computed on the Likert scale and the chi square statistical method was used in calculating the data outcome for each of the hypotheses. The study employed a questionnaire developed on a four-point Likert scale of SA, A, D and SD for each item on it. Two hundred teachers of English Language, Mathematics and science subjects were randomly chosen as respondents.

Data Presentation and Analysis

Hypothesis 1: Ho – There is no significant role the English Language class can play in the learning of mathematics.

TABLE 1

ITEMS	FREQUENCY				
	SA	A	D	SD	TOTAL
2. Texts can also be used to raise the learning of mathematics, in conjunction with diagrams, symbols and figures.	114	82	4	0	200
5. English language as a medium of instruction accommodates many subjects.	141	59	0	0	200
6. Mathematics vocabulary can be learnt in the English Language class.	55	105	32	8	200
7. Creativity in the English Language class can aid the learning of mathematics.	82	95	14	9	200
TOTAL	392	341	50	17	800

The chi square statistical method was used to calculate the data outcome for the hypothesis with the following result:

χ^2 calculated = 122.86

Level of significance = 0.05

Df = (4-1) x (4-1) = 9

χ^2 value on chi square table = 16.919

Since χ^2 calculated is greater than ($>$) χ^2 value on chi square table, the null hypothesis is rejected. The implication of this is that the English Language class can play a significant role in the learning of mathematics. Out of 800 responses obtained, 733 (91.63%) believed that the English Language class can play a significant role in the

learning of mathematics while only 67 (8.37%) believed otherwise.

variegated approach to diversify methods for the learning of mathematics.

Hypothesis 2: Ho – There is no need for a

TABLE 2

ITEMS	FREQUENCY				
	SA	A	D	SD	TOTAL
1. An interesting method of topic presentation can promote students' interest in the topic.	168	32	0	0	200
3. The percentage of students that attain credit pass in mathematics can increase through better methods of learning.	132	64	4	0	200
4. Giving different opportunities of learning to students will make mathematics less boring and less abstract to them.	127	68	5	0	200
8. Teachers of English and teachers of Mathematics can collaborate for the benefit of the students.	105	68	18	9	200
	532	232	27	9	800

The chi square statistical method was used to calculate the data outcome for the hypothesis with the following result:

χ^2 calculated = 85.17

Level of significance = 0.05

Df = (4-1) x (4-1) = 9

χ^2 value on chi square table = 16.919

Since χ^2 calculated is greater than χ^2 value on chi square table, the null hypothesis is rejected. The implication of this is that there is a need for a variegated approach to diversify methods for the learning of mathematics. Out of the 800 responses obtained, 764 (95.5%) said there was a need for a variegated approach to diversify methods for the learning of mathematics. The remaining 36 (4.5%) thought otherwise.

Summary of Findings

This study found out that English Language, as a

subject, is ubiquitous as it permeates other subjects; mathematics is not restricted to calculations, symbols and workings; texts in various dimensions are available tools for the learning of mathematics; the English Language class can be used to aid the learning of mathematics; it is necessary and beneficial to diversify away from the traditional approach to the teaching of mathematics; mathematics can be made interesting and less abstract to students; there is a general acceptance of the global shift from disciplinary independence to disciplinary interdependence.

Discussion

In response to the first hypothesis, which states that there is no significant role the English Language class can play in the learning of mathematics, it was revealed that the English Language class can

play a significant role in the learning of mathematics. This is in line with Anthony and Mamokgethi (2007) who link the acquisition of mathematical knowledge to the use of language as a tool. It also reflects Eguare's (2006) submission that a teacher of English should be conscious that English language pervades other subjects and should therefore adequately equip his students. This is also the stand of Ezeifeka (2010) who mentions English for Specific Purpose (ESP). It underlines the agreement of Delaney (2000) and Rinehart (2018) that mathematical vocabulary can be learnt and mastered in English language class. It supports Polak's reference to how exercises in mathematical essay can lead to creativity.

Regarding the second hypothesis the findings upheld that a variegated approach to diversify methods for the learning of mathematics is necessary to enhance the learning of mathematics in Nigeria. This outcome amplifies the observation of George and Thomaskutty (2020) that there is need to relate mathematics to other disciplines to make it less boring. It re-echoes Helmenstine that better methods will elevate the problem solving skills of students. Belief in the collaboration of teachers of English and teachers of mathematics corroborates the position of Segarra et al (2018) and Appleby (2019). These outcomes validate the efficacy of the English Language classroom in enhancing the learning of Mathematics. This research work has also been able to reinforce the global dimension of this helpful hand of the English Language classroom; that is is not restricted by geographical factors.

Recommendations

Conspicuous recognition should be given to textual mathematics in practical terms. Secondary school education policy makers should give definite instructions for the inclusion of mathematical contents in applicable lessons in the English language class. Lessons in the English Language class on essay, comprehension, vocabulary development and speaking should be planned to periodically include mathematical

contents. Secondary school education stakeholders should recognize and adjust to the global shift from subject independence to subjects interdependence. Teachers of English Language in the secondary school should sustain their relevance through self-development and constant professional updating. Teachers of English Language and teachers of Mathematics should collaborate for the benefit of the students.

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