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DIFFICULT ENVIRONMENT AND SENIOR SECONDARY STUDENT ALGEBRA PERFORMANCE IN EMOHUA LOCAL GOVERNMENT AREA

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Abstract
This study investigated the effect of learning in a difficult environment on the Algebra performance of students in Emohua Local Government Area (LGA) of Rivers State. The quasi-experimental design was used. A sample of 194 senior secondary class one students participated in the study. Algebraic Problem-Solving Achievement Test (APSAT) and Leaning Mathematics in Difficult Environment Questionnaire (LEMDEQ) were used for data collection. The APSAT is a 25-item multiple-choice questions while LEMDEQ consisted of 40 items used to identify students learning in difficult or normal environments. The reliability of LEMIDEQ and APSAT were respectively 0.82 and 0.74 using Cronbach Alpha and test re-test method respectively. The mean and standard deviation were used to answer the research questions while Analysis of Covariance (ANCOVA) was used to test the hypotheses respectively. The findings revealed among others that there was no significant effect of learning in a difficult environment on the performance of students in mathematics; gender does not significantly influence the achievement of students learning in a difficult environment in mathematics. It was recommended among others that students should be provided with an adequate and conducive environment for effective learning of mathematics.

Keywords: Difficult Environment, Senior, Secondary, Student, Algebra Performance

Introduction

Education is a basic human right, and mathematics education is included in this category. Almost every aspect of human activity is influenced by mathematics in some way. Figures and digits are intrinsically linked to everything we do, at home and work. The home is not left out because Mathematics is mainly used in kitchen work to know the quantity of salt or magi spices to be added to a pot of soup. The rich and poor use mathematics in their real lives as basic operations. Mathematics education is a foundational and indispensable tool for a person's and a nation's scientific and economic advancement. It is an essential component of human thought and logic in his quest to comprehend the worldview of the environment in which he lives (Lynn & Bracado, 2009, Umameh, 2011, Nyaumwe & Mtetwa, 2013). According to Abiodun (1997), mathematics is the most important instrument accessible for creating hypotheses in the sciences, as well as in a variety of other professions. It is used in numerous domains of research to provide explanations for observations and experiments. A study conducted by Adeyegbe (1987) found that there is scarcely any field of research that does not include mathematical notions to describe its concepts and theories, as well as models. Mathematics is a discipline that studies the processes through which quantities sought may be deduced from those that are known or presumed to be known. Anyone who ignores mathematics may find themselves unable to advance in the sciences, or indeed in any other field of endeavour in the world. As a result, it is possible to understand why Ukeje (1997) opined that mathematics is necessary for science that science is necessary for modern technology, and that without modern technology, there is no modern civilization. However, the learning environment is likely to impact the performance of students in Mathematics.

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Basque and Doré (1998) stated that the learning environment is the entire variety of activities and components within which learning takes place. They further opined that the teaching and learning environment should have six roles, which include communicating, informing, producing, scaffolding, managing and collaborating. Frenzel et al. (2007) linked poor academic performance with a poor learning environment. Murugan and Rajoo, (2013) considered the social aspect of academic performance which is mainly the learning environment. This affirms the fact that the learning environment is associated with the learning outcomes of the students (Ashby et al., 2011). The classroom environment is related to mathematics achievement and self-efficacy beliefs (Danielsen et al., 2010, Eccles and Roeser, 2011). Maliki et al. (2009) established that the characteristics of students and their environments, the utilisation of teaching-learning models, instructional materials, as well as the structural ability of the students, all influence the achievement process.

Promoting education during and after crises can save and maintain lives, help achieve global development objectives, and promote long-lasting peace and progress. Realizing all of these advantages depends in large part on the calibre of education. Education, which is fundamentally political, has the ability to exacerbate social marginalization and intolerance depending on the subject matter covered (such as the curriculum), the delivery method (such as pedagogy, and student safety), and the degree of equality in the educational process (e.g. access). Education that is safe, pertinent, egalitarian, and encourages tolerance is the cornerstone for achieving the benefits associated with education in all contexts, including crisis and post-crisis situations (Winthrop & Mendenhall, 2006). Every environment has difficulties. The environment surrounding learning mathematics is not an exception. During the United Nations Millennium Summit held in September 2000, all member nations of the UN endorsed and pledged to work toward the achievement of eight goals by 2015, which formed an integral part of the UN Millennium Declaration. The goals were:

to eradicate extreme hunger and poverty;
achieve universal primary education;
promote gender equality and empower women;
reduce child mortality;
improve maternal health;
combat HIV/AIDS, malaria, and other diseases;
ensure environmental sustainability,
and develop a global partnership for development.

To fulfil the millennium development objectives, the Dakar World Education Forum was organised as a follow-up gathering to the World Conference on Education, which recognised learning in adverse contexts as aim number two among the declared goals. Ensuring that by 2015 all children, with special emphasis on girls, children in difficult environments and from ethnic minorities have access to and complete free and compulsory primary education of good quality; (United Nations, 2000). As stated in the conference materials from the 2003 conference on providing education in challenging circumstances, "Every environment has obstacles." Investigate alternative approaches to working around obstacles: the human potential to shift and adapt to perform under unusual circumstances should not be ignored. In addition, for this to happen, resources must be dedicated to supporting the individuals who are providing the skills. Change is something that should be welcomed. According to Hesketh (2012) children are in tough situations when their fundamental requirements for food, housing, education, medical treatment, or safety and security are not addressed, such as when they lack access to safe drinking water. Any effective definition of tough situations is heavily reliant on the socio-economic and cultural context in which it is developed and implemented.

As stated by Aguele and Usman (2007), to master the fundamental mathematical skills required for the twenty-first century, kids need a non-threatening setting in which they are encouraged to ask questions and take calculated risks. High expectations for all kids regardless of race, insecurity and socioeconomic level among others should be considered in the learning environment. Students must study mathematics concepts via the use of manipulatives, measuring equipment, models, calculators, and computers. They must be allowed to converse with one another about mathematics and other subjects. Students need styles of education that are appropriate for increasing focus on problem-solving, applications, and higher-order thinking abilities that have been placed on them in recent years. Winthrop (2006), in her paper on education in emergencies, draws attention to the fact that difficult environments such as conflict, acute poverty, the aftermath of a natural disaster, special needs for the disabled, geographic isolation, and the prevalence of diseases such as tuberculosis, malaria, and HIV/AIDS are all possible. Munro (2003) noted that lack of

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interest, low self-efficacy, high anxiety, and inappropriate earlier teaching are some of the causes of poor mathematical performance. This study seeks to explore learning mathematics in difficult environments as a major factor contributing to the poor performances of students in Rivers State. The effort of the State Governor is commendable for the model secondary schools built but not all students especially those in remote villages benefited. As defined in the education section of the commonwealth, "difficult" environments are defined as those in which "conflict, acute poverty, the aftermath of a natural disaster, special needs for the disabled, geographic isolation, and the prevalence of diseases such as tuberculosis, malaria, and HIV/AIDS are prevalent." As a result, learning in difficult surroundings is defined as perceived to be difficult by the students, learning in a crisis-dominated region, and learning in an acutely impoverished environment in this research.

Statement of the problem

The results of the Senior School Certificate Examination (SSCE) show that students have not been performing well in mathematics (Zalmon & Wonu, 2017). Following the poor performance of students in mathematics, researchers have come up with studies to implicate teaching methods on student achievement, student factors such as negative attitude towards mathematics, mathematical anxiety, gender factor, socio-economic status of parents and mathematics learning disability to mention among others as responsible for the situation. To the best of the researchers' knowledge, no studies in Nigeria and specifically in Rivers state have looked into this area of learning in difficult environments. This has shown the essence of the study. In line with the foregoing, this study investigated the effects of learning in difficult environments on the academic achievement of students in Algebra.

Purpose of the study

The purpose of the study is to investigate the effect of learning in difficult environments on student achievement in Algebra. In specific terms, this study was carried out to:

1. investigate the effect of learning in difficult environments on student achievement in Algebra.
2. determine the effect of gender on the achievement of students learning Algebra in difficult environments.
3. determine the effect of gender on the achievement of students learning Algebra in a normal environment

Research questions

The following research questions were answered to guide the investigation:

1. What is the effect of learning environment on students' achievement in Algebra?
2. How does gender affect the achievement of students learning Algebra in difficult environment?
3. How does gender affect the achievement of students learning in a normal environment in Algebra?

Hypotheses

1. There is no significant effect of the learning environment on the Algebra achievement of senior secondary students
2. Gender does not significantly influence the achievement of students learning in a difficult environment in Algebra.

Methods and Materials

Research design: The quasi-experimental research design was utilised in this study. Quasi-experimental research is one in which certain risks to internal and external validity cannot be fully addressed because of unavoidable conditions related to the investigation.

Participants: The population of this study was all the co-educational senior secondary class one students learning in difficult environments in Emohua Local Government Area (LGA). The senior secondary class one class was particularly chosen because it is a transited class where students mainly experience the traits of difficulty, as they tend to adjust to seniority. A sample of 194 students participated in the study. Four (4) schools were purposively chosen from the area of study. Then a diagnostic instrument was used to identify the students learning in a difficult environment. In each of the selected schools/classes, students identified as learning in a difficult environment and those learning in a normal environment were allowed to study together in intact classes, because doing otherwise could result in disorganisation of the classes in the schools.

Diagnosis, identification and selection: To separate students 'learning mathematics in difficult environments from those learning in an normal situation in the schools, an assessment on Learning Mathematics in Difficult Environments Questionnaire (LEMDEQ) was constructed and administered to senior secondary one students. The criteria for inclusion:

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1. The students' responses on the 25 items measuring their learning mathematics in a difficult environment were computed using a mean cut-off of 2.5.
2. Students with overall mean scores greater or equal to the criterion mean (2.5) were considered as learning in a difficult environment while those with a mean score below 2.5 were considered as learning in a normal environment. Not all students identified as learning in a difficult environment participated in the study. Then, 194 students participated in the study, comprising 106 students learning under normal environment and 88 students learning in difficult environments respectively. The identified students learning in difficult environments and those learning under normal situations were taught and assessed and the scripts of the students selected from each school were used for data analysis.

The instrument for data collection: Two instruments were simultaneously developed and used in data collection for this study namely: Learning Mathematics in Difficult Environments Questionnaire (LEMDEQ) and Algebra Problem Solving Achievement Test (APSAT). To distinguish students studying in a typical environment from their peers, the LEMDEQ was employed. During the development of the instrument, elements such as the amount of time available for the test, the kind of test items to be utilised, and other considerations such as the age of the students, their ability level, and the type of process goals to be assessed were taken into account.

Algebra Problem Solving Achievement Test (APSAT): The Algebra problem-solving achievement test is an objective test, which measured the Algebra problem-solving achievement of the students. This test was constructed based on the items of past senior secondary certificate examination (SSCE) and the scheme of work for Senior Secondary Class one (SSC1). The APSAT consisted of 25 items which included multiple-choice to be marked over 100. The APSAT was based on five content areas in Algebra for SSC1 students (Linear Equations, Word problems leading to linear equations, Linear Inequality, Word problems leading to linear inequalities and Change of subject of a Formula). The total number of items for each topic, process objectives based on the relative importance and the time spent in teaching the topics guided the decision on the design of APSAT using the table of specification

Table 1 of specifications for APSAT

	Process objectives			
Content topics	**Knowledge 24%**	**Comprehension 28%**	**Application 48%**	**Total**
Linear Equations (20%)	2	1	2	5
Word problems leading to linear equations (20%)	1	1	3	5
Linear Inequality (20%)	1	1	3	5
Word problems leading to linear inequalities (20%)	1	2	3	6
Change of subject of a Formula (20%)	1	2	1	4
Total (100%)	**6**	**7**	**12**	**25**

Scoring of the instruments: To differentiate between LEMIDEQ and APSAT, several scoring techniques were applied. The Likert scale was used to score the students' responses, such that for favourably phrased questions, Strongly Agree (4 points), Agree (3 points), Disagree (2 points), and Strongly Disagree (1 point). The APSAT scripts were marked over 100, such that each erroneous answer received a score of zero and the correction option had 4 marks, the overall score was above 100.

Reliability of instrument: With the use of the test-retest approach, the reliability of the instruments APSAT and LEMIDEQ was determined. It was necessary to employ a simple random selection procedure to draw a sample of 20 students who were learning mathematics in challenging circumstances. This group of students did not take part in the main study. The sample was administered copies of the instruments that had been created. They were instructed to try every item on the APSAT. After a 2-week gap, only duplicates of the APSAT were given to the same sample for them to react to the second time. The correlation between the subject's initial and re-test scores was calculated for the complete instrument using Pearson Product Moment Correlation, and the result was a reliability coefficient of 0.74 for the entire instrument. To calculate the reliability of LEMDEQ, the Cronbach Alpha formula was utilised, resulting

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in an index of 0.82. To make calculations and data processing easier, the Statistical Package for Social Sciences (SPSS Statistics 17.0) software was utilised.

Data collection: The teacher in the experimental group received an orientation (training) on both the theoretical and practical aspects of the experiment using a lesson note prepared by the researchers for the study. Before the commencement of the session, the teacher administered the APSAT and LEMDEQ to each group as a pretest. The LEMDEQ was used to identify students learning mathematics in a difficult environment. A 30-minute time limit was set for students to solve the problems on APSAT. The copies of the scripts were retrieved from the students before the start of the lesson. The students in the experimental group was taught Algebra in an unconducive/difficult environment whereas the students in the control group was taught in a better learning environment. They used identical learning materials in both groups. The experiment lasted for five (5) weeks and included the use of regular mathematics teachers from the sampled schools in both groups. The teachers in the experimental and control groups were comparable in terms of age, gender, fields of study and years of teaching experience. By the end of the instructions, both groups attempted items on APSAT as a posttest.

Data Analysis

Pre-test and post-test scripts were marked and scores were recorded for both groups of students on the same day. Afterwards, the manually coded scores (learning in challenging situations, learning in normal environments, gender, school location, etc) were uploaded on the data editor in the Statistical Package for Social Sciences (SPSS) software for further analysis. The scores from both the pre-test and the post-test were utilised in the data analysis. In the course of the investigation, descriptive and inferential statistics were used. Analysis of Covariance (ANCOVA) was used to test hypotheses, whilst mean and standard deviation were employed to answer the research questions.

Results

Table 2: Mean and standard deviation on learning environments and student achievement in mathematics

		Pre-test		Post-test		
Learning environment	**N**	**Mean**	**SD**	**Mean**	**SD**	**Gain**
Difficult	88	34.41	8.03	49.82	7.97	15.41
Normal	106	35.62	7.79	50.75	6.97	15.13

Table 2 shows that the students learning in difficult environments had a pre-test mean score of 34.41±8.03 while their post-test mean score was 49.82±7.97, and the Mean Difference Within-group(MDWG) was 15.41. Furthermore, the Table indicated that the students learning in normal environments had a mean pre-test score of 35.62±7.79 while their post-test mean score was 50.75±6.97, and the MDWG was 15.13. The Mean Difference Between Groups (MDBG) in the pre-test was 1.21 while that of the post-test was 0.93.

Table 3: Mean and standard deviation on the effect of gender on the achievement of students learning in a difficult environment

		Pre-test		Post-test		Gain
Sex	**N**	**Mean**	**SD**	**Mean**	**SD**	
Male	37	34.38	8.56	49.41	7.50	15.03
Female	51	34.43	7.72	50.12	8.37	15.69

Table 3 shows that the male students learning in difficult environments have a pre-test mean score of 34.38±8.56 while their post-test mean score was 49.41±7.50. Furthermore, the female students learning in a difficult environment had a pre-test mean score of 34.43±7.72 while their post-test mean score was 50.12±8.37. The gain within the male group is 15.03 whereas the gain with the female group is 15.69

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Table 4: Mean and standard deviation on the effect of gender on the achievement of student learning in a normal environment

		Pretest		Posttest		Gain
Sex	**N**	**Mean**	**SD**	**Mean**	**SD**	
Male	60	35.40	8.36	49.93	6.40	14.53
Female	46	35.91	7.10	51.83	7.59	15.91

Table 4 shows that the male students who learnt in normal environments had a pre-test mean score of 35.40±8.36, while their post-test mean score was 49.93±6.40. Furthermore, the female students learning in a normal environment had a pre-test mean score of 35.91±7,10 and a post-test mean score of 51.83±7.59. The gain within the male group was 14.53 while the gain with the female group was 15.91

Table 5: Summary of ANCOVA on the effect of learning environment on the algebra performance of senior secondary students

Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**
Corrected Model	514.412[a]	2	257.206	4.835	.009	.048
Intercept	17496.998	1	17496.998	328.914	.000	.633
Pretest	472.239	1	472.239	8.877	.003	.044
Learning Environment	23.143	1	23.143	.435	.510	.002
Error	10160.475	191	53.196			
Total	502096.000	194				
Corrected Total	10674.887	193				

a. R Squared = .048 (Adjusted R Squared = .038)

Table 5 shows the summary of ANCOVA on the effect of the learning environment on the Algebra achievement of senior secondary students. It shows that there is no significant effect of learning in a difficult environment on students' achievement in Algebra (F1, 191=.435, p>.05). The Partial Eta Squared was .002. The null hypothesis one was retained at a .05 level of significance.

Table 6: Summary of ANCOVA on the effect of gender on the algebra performance of senior secondary students learning under difficult circumstances

Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**
Corrected Model	202.592[b]	2	101.296	1.615	.205	.037
Intercept	8471.953	1	8471.953	135.094	.000	.614
Pretest	191.714	1	191.714	3.057	.084	.035
Gender	10.581	1	10.581	.169	.682	.002
Error	5330.499	85	62.712			
Total	223936.000	88				
Corrected Total	5533.091	87				

a. learning environment = Difficult circumstance

b. R Squared = .037 (Adjusted R Squared = .014)

The result from Table 6 showed that the ANCOVA analysis was used to determine the influence of gender on the Algebra achievement of senior secondary students who were studying under challenging conditions. The results are summarised in Table 5. It demonstrates that gender has no significant impact on the mathematics success of pupils studying in a demanding context (F1, 85=.169, p>.05). At the .05 level of significance, null hypothesis number two was retained.

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Discussion of findings

The learning environment and student achievement in mathematics

The result in Table 2 shows that the mean gain in the Algebra achievement of the students who learned in difficult environment was higher than that of their counterparts who learned in a normal environment because of instructional treatment. However, the post-test achievement score of students learning in a normal environment was higher than those of their counterparts. Moreover, when subjected to statistical analyses, the results of Table 5 revealed that there is no significant effect of the learning environment on students' performance in mathematics. This finding is inconsistent with the findings of Maliki, et al. (2009), who found that the characteristics of students and their environments, the utilisation of teaching-learning models, instructional materials, as well as the structural ability of the students all influence the achievement process.

Gender, learning environment and student algebra performance

The results of Tables 3 and 4 revealed that the mean increase in achievement of female students studying in a challenging setting was greater than the mean gain in the achievement of male students. Aside from that, the post-test scores of female students were higher than those of male students. Furthermore, when subjected to a statistical test, the results of Table 6 revealed that there is no s a significant difference between male and female students' Algebra achievement. This finding may be connected to the fact that pupils' success in mathematics may not be affected by their gender in certain cases. This is following the findings of Howes (2002) and Sinnes (2005). They supported programmes that were based on the concept that girls and men are equal in their approach to science, and that inequalities in science and education are created by political, educational, and societal forces that are external to the field of science. As a result, the emphasis should be on reducing these extrinsic impediments.

Conclusion

The learning environment had no significant effect on the achievement of students in Algebra. Gender also had no significant influence on the Algebra achievement of students learning in difficult environment. The study established that irrespective of the learning environment when students are taught very well, the influence of the learning environment on their performance could be minimal irrespective of their gender. The overall achievement of the students in Algebra was somewhat encouraging. However, the poor performance of the students in Algebra is due to the overall crisis-dominated environment.

Recommendations

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

1. Students should be provided with an adequate and conducive environment for effective instruction to take place in mathematics.
2. Students of both sexes should be equally engaged in the mathematics classrooms to close up the gender gap between male and female students in mathematics achievement.

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