MODERN TEACHING STRATEGIES AND MATHEMATICS ACADEMIC ACHIEVEMENT AMONG JUNIOR SECONDARY SCHOOL STUDENTS IN POST– COVID–19 ERA IN CALABAR EDUCATION ZONE, CROSS RIVER STATE, NIGERIA.

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ABSTRACT

This study assess modern teaching strategies and mathematics academic achievement among junior secondary school students in post– covid–19 era in Calabar education zone, Cross River State, Nigeria. Three research questions and hypotheses were formulated to provide focus and to direct the study. The design of this study is quasi-experiment design involving pre-test-post-test. The sampling technique adopted in the study was a simple random sampling technique. The sample comprised of 90 Junior Secondary School III Mathematics Students. Two instruments were used for data collection; the first involved the design of one instructional package on modern teaching strategies and the second instrument was a Mathematics Achievement Test (MAT). The experimental group was taught using modern teaching strategies while the control group was taught using the conventional teaching method. The data obtained were analysed using analysis of covariance (ANCOVA). The result revealed that students taught with innovative teaching strategies, modern technologies and using of mother tongue outperformed those taught using the conventional teaching method. It was recommended that school administrators and government should organize workshops to introduce teachers to modern teaching strategies using innovative teaching, modern technology and using of mother tongue to enhance learning. Efforts should be made to provide well-equipped mathematics laboratory to junior secondary schools to support these modern teaching approaches.

INTRODUCTION

The novel corona virus was initially named 2019-nCoV and officially as severe acute respiratory syndrome corona virus 2 (SARSCoV-2).

As of February 26, COVID19 has been recognized in 34 countries, with a total of 80,239 laboratory-confirmed cases and 2,700 deaths (WHO, 2020).Going to school is the best public policy tool available to develop skills and

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potentials, school time can be fun, and from an economic point of view the primary point of being in school is that it increases a child's ability to become a useful and acceptable member of the society. Even a relatively short time in school has a longer impact in the life of a child; a short period of missed school may have consequences for skill growth in future. This is why we cannot estimate how much the COVID-19 interruption will affect learning; it is only the visible effect we can see, the gradual decay of inbuilt abilities may not be easily noticed very precisely.

The outbreak of corona virus has shaken the educational sector of Nigeria off its strength. In fact, looking at the trend of the pandemic, it could be something we are going to live with for a long period of time. There is no doubt that there is going to be a serious set-back in the development of Nigeria education system if the corona virus pandemic lockdown is not properly managed by the government and concern personnel. Schools calendar have been disrupted, there is reduction in the economic development of the country which has affected the education finance as well. Since the family income depends on the economic growth of any country, most of the families in Nigeria are experiencing economic hardship as a result of the pandemic lockdown; some of the vulnerable families having their children under the federal government free feeding scheme are being faced with the challenge of going in search of food for their children while they are with them at home. This is certainly a trying time for the economy, a hit on the sustainable development of the country and it is not going to be an easy experience for some households who could barely afford daily balanced diet who have been sacrificing a lot for their children to get the best education for them to become a useful and acceptable member of the society. The outbreak of the corona virus coupled with the lockdown of schools at various levels of education in Nigeria has served as test for the education technology interventions for teaching-learning activities.

The achievement of any educational objectives has largely depended on the successful implementation of curriculum master plan that reflect the philosophical needs and objectives of education in the country. According to Ojerinde cited in Ekwueme and Meremikwu (2010), mathematics is a tool for use in science, technology, and industries; and if mathematics is really the tool for use in science, technology, and industries, then the mathematics curriculum should be such that will have leading contents to

those areas and involvement of competent mathematics teachers that will be abreast with the content.

The restriction of movements and social distancing, occasioned by the COVID-19 pandemic have brought changes in methods and strategies of teaching and learning. Therefore, there is a need for alternative approaches to teaching of Mathematics, which is with the use of modern teaching strategies. In the course of learners' and teachers' interaction in the classroom, different strategies are adopted to enhance understanding. Odogwu in Okri and Aglazor (2020) describe strategies in Mathematics teaching and learning as the procedures and processes used with the mathematics concepts under consideration. Strategy also represents the plan that is intended to be adopted or can also be described as the process of planning something and putting it with skillful operation. The intended strategies to be applied depends on the learning objectives in focus, and this in the long run affects how the class will be arranged and the activities for both the students and teachers that will eventually lead to the attainment of the objectives. The performance of students depends greatly on the instructional strategies adopted by the teachers (Okri and Aglazor, 2020). These strategies are important because students have different levels of understanding. The topics as well as the intended objectives under consideration are also different. This, therefore, means that if the same strategy is adopted for all lessons, the teacher cannot be effective.

The ultimate goal of integrating modern teaching strategies into the classroom is to facilitate learning efficiently and create a positive change in students' academic performance. It is the teachers' responsibility to equip students with knowledge that will enable them face the challenging world that relies heavily on mathematics, science and technology (Ekwueme, 2017). Consequently, teachers need to be ready to accept current changes and take the initiatives of education (Ekwueme & Meremikwu, 2007).

The National Policy on Education requested that students up to the Junior Secondary School level are taught mathematics in the language of their environment (FGN, 2004) cited in Meremikwu (2017). Research has shown that a child's first language is the optimal language for literacy and learning throughout primary school (Meremikwu, 2017). Using the language which the learner is familiar with will help to win more students in mathematics. Many

countries around the world (e.g. Asia, Africa and Europe) have developed policies on the use of the mother -tongue for teaching science and mathematics in the lower levels of their education (Okebukola, Owulabi & Okebukola 2006 cited in Meremikwu (2017). The researcher further asserted that using mother –tongue to teach science in lower basic primary school, found that those taught using mother – tongue performed better than those taught with the official language.

The importance accorded mathematics notwithstanding; many students in the Junior Secondary level still find it difficult to cope with the subject. Though some of these students may exhibit traits of interest in mathematics; it is clearly evident that the teaching and learning process is still void of the experiences, innovations and creativities needed to jolt and motivate their young and energetic minds into exploring the vast field of mathematics (Shirley, 2008). The Junior Secondary level is the stage were students ought to make meaning of mathematics, its usefulness to life and application to further studies. It is the stage where decision to pursue mathematics related subjects and career in future is made; hence teaching and learning of the subject with creativity, experiments and hands-on activities becomes were crucial. This is to avoid pushing the career decisions of these young learners to hinge on bias and of course, regrets.

There is ample evidence to show that all over the world, majority of Secondary School students' performance in mathematics have been variously reported by individuals and group of persons to be generally poor. For instance, reports on students' poor performance on mathematics were noted (WASCE Chief Examiners' report, 2017 - 2021). It is unfortunate that the general performance of students in mathematics has been observed to be poor (WASCE Chief Examiners' report, 2021). This situation cannot be allowed to continue escalating without proper check. Some researchers noted that it was associated with poor teaching of the subject (mathematics) by teachers (Shirley, 2008; Ekwueme & Meremikwu, 2007). Specifically, accusing fingers have been pointed at the way mathematics is taught in schools, and the lack of relevance of mathematics content to the student's real life experiences (Ekwueme, 2017). Some reported that students detest mathematics, suggesting that the students are not working hard enough or learning the subject seriously. For instance, the inability of students to change to a

thinking mode suitable for the particular problem, or representing mathematical ideas deterred them from solving a wide range of mathematical problems (Orim & Opoh, 2022).

There are gaps of literatures in integrating modern teaching strategies in Calabar education zone. Hence, it is pertinent to carried out the study to assess modern teaching strategies and mathematics academic achievement among junior secondary school students in post– covid–19 era in Calabar education zone, Cross River State, Nigeria, with the hope of addresses the research gaps and questions.

STATEMENT OF THE PROBLEM

The importance of Mathematics for Sustainable Development Goals (SDG) and growth of any nation is not in doubt. People use Mathematics knowingly and unknowingly in solving their day-to-day problems. It is very true that Mathematics is a model of thinking and a very crucial tool in both Science and Arts. The persistence of poor academic achievement among junior secondary school Mathematics students in Nigeria has become of great concern to all stakeholders in education. Research has shown that teacher-centered instructional approach has dominated the teaching of Mathematics in Nigerian educational system including the Calabar education zone of Cross River State. There is a need to adopt modern teaching strategies which may have the capacity to improve the mindset of students' and enhance their academic achievement in junior secondary school Mathematics, This study seeks to find out the strategies for effective implementation of Mathematics curriculum and students' academic achievement.

PURPOSE OF THE STUDY

The purpose of this study is to investigate modern teaching strategies and mathematics academic achievement among junior secondary school students in post– covid–19 era in Calabar education zone, Cross River State, Nigeria.

Specific Objectives

1. Examine the effects of use of innovative teaching strategy on JSS students' academic achievement in Mathematics.
2. Investigate the effect of modern technologies strategy on JSS students' academic achievement in Mathematics.
3. Determine to what extent JSS students taught with use of mother tongue strategy differ with those taught in conventional method.

Research Questions

1. To what extent do the use of innovative teaching strategy influence JSS students' academic achievement in Mathematics?
2. To what extent do JSS students taught with use of mother tongue strategy differ in student's academic achievement in Mathematics from those taught with conventional approach?
3. What is the significant effect of modern technologies strategy on JSS students' academic achievement in Mathematics?

Research Hypotheses

1. There is no significant influence of the innovative teaching Strategy on JSS students' academic achievement in Mathematics.
2. There is no significant effect of JSS students taught with use of mother tongue strategy and with those taught with conventional method.
3. There is no significance effect of modern technologies strategy on JSS students' academic achievement in Mathematics.

METHODOLOGY

The design of this study is quasi-experiment design. This design considered appropriate because it is applied to a situation which is not purely experimental in nature involving human beings especially when all the threat to validity cannot be controlled. As a result, since the study was conducted under quasi-experimental conditions that do not permit total control, manipulation of variables or random selection of participant, the intact groups or classes were used to investigate the strategies for effective implementation of Mathematics curriculum and JSS students' academic achievement. Also, Junior Secondary School (JSS 3) students who participate in the study received treatment in their usual classes and were used as control in their classes without re-arranging the class setting.

The total population of this study comprised all Junior Secondary (JSS 3) Mathematics Students in Calabar South Education Zone. The sampling technique adopted in this study is simple random sampling technique. Two junior secondary schools were purposively selected for participation based on the two criteria listed below:

a. The school must have registered students for the Basic Certificate Examination (BECE) for at least 10 years.
b. The junior secondary schools should be co-educational schools.

Only one arm of Junior Secondary School (JSS 3) class was randomly selected for participation in each of the two schools. The students in the selected arms of JSS 3 classes in one of the schools were randomly assigned to the experimental groups, while the control group was assigned to the second school. A pre-test was administered to establish the homogeneity of the groups. Total of ninety (90) students (38 males and 52 females) from the two co-educational schools comprises of forty (40) students (18 males and 22 females) for the innovative teaching strategies and a total of 50 students (20 males and 30 females) participant for the conventional method were chosen as sample for the study.

The study used two instruments, the first was non-cognitive which involved the design of one instructional package on innovative teaching strategies and the second instrument for data collection in this study was consisted of Mathematics Achievement Test (MAT). The development of MAT which was used for this study involved the following stages:

a. Content base Mathematics.
b. Instrument Strategy Objectives.
c. Table of specification.

To determine the reliability of the Mathematics Achievement Test on students' academic achievement, a trial test was conducted with 30 secondary schools students who were not part of the study sample. The 20 items on Mathematics achievement test passed the faced validation by other experts in test and measurement department in Faculty of Educational Foundations, University of Calabar. The reliability co-efficient of the MAT was determine with the use of Kuder Richardson formula KR-21 reliability method. The scores obtained from the administration of the instrument were analyzed using KR-21 to obtain an index of reliability of the instrument 0.72.

Procedure of Data Analysis

The pre-test and post-test of MAT scores of the participants or subject were used. The hypotheses were tested at .05 level of confidence and the specific procedures for data analysis are shown below.

RESULTS

Hypothesis 1

There is no significant influence of the innovative teaching Strategy on JSS students' academic achievement in Mathematics. Analysis of Co-variance was employed to test data collected in respect to this hypothesis. The summary of result is as presented in table 3

Table 3

Analysis of Co-variance of the difference in Mean Scores of Experimental and Control Groups in the schools of study

Variable	N	X	SD		
Experimental group					
Control group	50	13.14	2.32		
Total					
	40	6. 40	2.51.		
	90	9.77	2.42		
Source of variation	SS	Df	MS	F	Sig.
Corrected model	2723.22[a]	2	1332.32	31.456	.000[b]
Intercept	1731.13	1	1731.13		
Experimental/Control	2413.20	1	1132.32	35.21	
Pretest	131.34	1	1371.34	33.72	
Error	122.12	1	3.315	38.37	
	2333.02	88		*18.12	
Total	3073.20	90			
Corrected Total					

*significant at .05; df 1, 1 & 88; critical f –value = 2.33

The above table presents the obtained F-value as 18.12. This value was tested for significance by comparing it with the critical F-value at 0.05 level with 1,1 & 88 degree of freedom. The obtained F-value (18.12) is greater than the critical F-value (2.33). Hence, the result is significant. The result therefore shows significant difference in the mean scores of experimental and control groups in the schools of study with the use of innovative teaching strategies.

Considering the difference in the mean scores of experimental and control groups, the result of data analyzed in Table 3 shows that the mean scores of experimental group is higher than that of the control group. This means that the difference between them is significant. The experimental group makes use of automaticity in learning.

Hypothesis 2

There is no significant effect of JSS students taught with use of mother tongue strategy and with those taught with conventional method. Analysis of Co-variance was employed to test data collected in respect to this hypothesis. The summary of result is as presented in table 4

Table 4

Analysis of Co-variance of the difference in Mean Scores of Experimental [Mother Tongue strategy (MT)] and Control Groups [Conventional Method (CTM)] in the schools of study

Variable	N	X	SD		
Experimental group					
Control group	50	23.32	2.33		
Total					
	40	14.01	3.51		
	90	18.67	2.92		
Source of variation	SS	Df	MS	F	Sig.
Corrected model	2483.23	2	2132.43	38.21	.000[b]
Intercept	1921.15	1	1974.31		
Experimental/Control	2835.42	1		37.31	
Pretest	206.38	1	1713.50	34.82	
Error	1821.02	1	1537.52	36.21	
	2831.42	88	7.3517	*21.02	
Total					
Corrected Total	2973.42	90			

*significant at .05; df 1, 1 & 88; critical f –value = 2.33

The above table presents the obtained F-value as 18.12. This value was tested for significance by comparing it with the critical F-value at 0.05 level with 1,1 & 88 degree of freedom. The obtained F-value (21.02) is greater than the critical F-value (2.33). Hence, the result is significant. The result therefore shows significant difference in the mean scores of experimental and control groups in the schools of study with the use of innovative teaching strategies.

Considering the difference in the mean scores of experimental and control groups, the result of data analyzed in Table 4 shows that the mean scores of experimental group [Mother Tongue strategy (MT)] is higher than that of the control group [Conventional Method (CTM)]. Thus, the null hypothesis which states that there is no significant effect of JSS students taught with use of mother tongue strategy and with those taught with conventional method was rejected and the alternative hypothesis upheld. This means that the difference between them is significant.

Hypothesis 3

There is no significance effect of modern technologies strategy on JSS students' academic achievement in Mathematics. Analysis of Co-variance was employed to test data collected in respect to this hypothesis. The hypothesis was tested at 0.05 level of significant. The summary of result is as presented in table 5.

Table 5

Analysis of Co-variance of the difference in Mean Scores of Experimental [modern technologies strategy] and Control Groups [Conventional Method (CTM)] in the schools of study

Variable	N	X	SD		
Experimental group					
Control group	50	26.12	3.21		
Total					
	40	16.43	3.31		
	90	21.28	3.26		
Source of variation	SS	Df	MS	F	Sig.
Corrected model	2247.53	2	3025.21	34.87	.000[b]
Intercept	2205.31	1	2134.57		
Experimental/Control	2685.42	1		35.97	
Pretest	369.38	1	1935.32	35.426	
Error	2023.12	1	1731.56	34.87	
	2820.60	88	9.1315	*19.64	
Total					
Corrected Total	3123.42	90			

*significant at .05; df 1, 1 & 88; critical f –value = 2.33

The above table presents the obtained F-value as 18.12. This value was tested for significance by comparing it with the critical F-value at 0.05 level with 1,1 & 88 degree of freedom. The obtained F-value (19.64) is greater than the critical F-value (2.33). Hence, the result is significant. The result therefore shows significant difference in the mean scores of experimental and control groups in the schools of study with the use of innovative teaching strategies.

Considering the difference in the mean scores of experimental and control groups, the result of data analyzed in Table 5 shows that the mean scores of experimental group [Mother Tongue strategy (MT)] is higher than that of the control group [Conventional Method (CTM)]. Thus, the null hypothesis which states that there is no significance relationship between modern technologies strategy and JSS students' academic achievement in Mathematics was rejected and the alternative hypothesis upheld. This means that the difference between them is significant.

DISCUSSION OF FINDINGS:

The first hypothesis states that there is no significant influence of the innovative teaching strategy on JSS students' academic achievement in Mathematics. This null hypothesis was rejected on the ground that the calculated F-values obtained from the analysis of data were statistically greater than the critical F-value at .05 then the null hypothesis was rejected, and this implies that innovative teaching strategies have significant influence on mathematics achievement of students.

The finding of this hypothesis testing, agree with the earlier finding of Ekwueme (2017) who asserted that the ultimate goal of integrating technology into the classroom is to facilitate learning efficiently and create a positive change in students' academic performance. The researcher further revealed that it is the teachers' responsibility to equip students with knowledge that will enable them face the challenging world that relies heavily on mathematics, science and technology. Consequently, teachers need to be ready to accept current changes and take the

initiatives to adapt teaching methods in mathematics education accordingly.

The second hypothesis states that there is no significant effect of JSS students taught with use of mother tongue strategy and with those taught with conventional method. The result indicates that the experimental and control groups differ significantly from each other in academic achievement. Based on this result, therefore, hypothesis 2 is rejected.

The finding of this hypothesis agrees with the earlier finding of Meremikwu (2017) who showed that using the language which the learner is familiar with will help to win more students in mathematics. The researcher further asserted that using mother–tongue to teach science in lower basic primary school was effective, as it found that those taught using mother – tongue performed better than those taught with the official language.

The third hypothesis states that there is no significant relationship between modern technologies strategy and JSS students' academic achievement in Mathematics. This null hypothesis was also rejected on the ground that the calculated F-values obtained from the analysis of data were statistically greater than the critical F-value. The implication of this result is that there is a significant relationship between modern technologies strategy and JSS students' academic achievement in Mathematics in the study area.

The finding of this hypothesis is in line with the earlier position of Ekwueme & Meremikwu (2007) who stressed that teachers need to be ready to accept current changes and take the initiatives of improving mathematics education by integrating modern technologies strategy in classroom instructions.

CONCLUSION

Based on the findings of this study, we conclude that academic achievement of JSS students in Mathematics can be significantly enhance by the use of innovative teaching strategy, mother-tongue teaching strategy, use of modern technologies and the strategy of simplifying teaching with games. . Training and re-training of teachers in these strategies will help to enhance the needed qualitative education. Also providing essential infrastructure and textbooks will promote the smooth administration of instruction and enhance understanding of mathematics at the Junior Secondary school level.

SUGGESTION/ RECOMMENDATIONS

We recommend that government should regularly organize workshops, seminars, and short-term training to improve the capacity of mathematics teachers to apply the strategies shown by this study to positively influence students' academic achievement in mathematics namely innovative teaching strategies, the use mother tongue, modern technologies and simplifying with games strategy. Workshops on specific subjects should be organized separately for more effective coverage. Special workshops should be organized to handle specific themes where special difficult content/themes should be treated for greater understanding. Seminars should be organized for teachers before implementation of any new policy to educate and intimate them on the aims and objectives of such programmes. Efforts should be made to provide well-equipped mathematics laboratory to junior secondary schools to support these innovative teaching approaches. Also, Since it was observed that there were no proper plans in place to curb and manage the influence of corona virus on the educational system, it is highly recommended for the government and concerned educational personnel should ensure there are futuristic plans to in case of another similar experience. This is COVID-19, nobody knows what other occurrences will happen in future and will lead to interruption of the activities of the educational system of Nigeria, therefore plans are to be made in ensuring the future of the education system is secured and not been disrupted with emergence of disease.

REFERENCES

Asoegwu, A. O., 2012. Developing curriculum on climate change at tertiary education in Nigeria; Stiffaith Print Calabar: 1(2), 14-18.

Ekwueme, C. O., 2006. Process errors and teachers characteristics as determinants of secondary school students' academic achievements in senior secondary certificate examination in mathematics in Nigeria (Unpublished doctoral dissertation, University of Nigeria, Nsukka).

Ekwueme, C. O., 2017. The Use of Innovative Teaching Strategies and Modern Technologies in Mathematics Instruction: A Book of Readings in honour of Prof. O.I. Enukoha. Published by Stiffaith Prints and Supplies Co.: 1(1), 199–209.

Ekwueme, C. O., and Meremikwu, A., 2007. Redefining mathematics classroom culture: A case study of senior secondary schools in Cross River State, Nigeria. A paper presented at 2nd International Conference on Science and Mathematics Education, SEAMED (COSMED), Penang, Malaysia.

Ekwueme, C. O., and Meremikwu, A., 2010. Evaluation of the Millennium Development Goals Project (MDG) for primary school teachers in Nigeria: Teacher's perspective. International Journal of Research in Education, 2(6), 84-88.

Lassa, P. N., 2004. The Sorry State of Mathematics Education in Nigeria: An inaugural Address, University of Jos, Nigeria

Meremikwu, A., 2017. Teaching and Learning Mathematics in the Mother Tongue: Issues in Education, Science and Technology; A Book of Readings in honour of Prof. O. I. Enukoha. Stiffaith Prints and Supplies Co.: 1(1), 124 – 137.

Okri, J. A. and Aglazor, G., 2020. Relative Effectiveness of Three Instructional Strategies on Students' Academic Performance in Mathematics in Ikom Education Zone, Cross River State, Nigeria. European Journal of Social Sciences: 60(4), 250 – 264.

Orim, R. E. and Opoh, D. A., 2022. Cultural practices and mathematics academic performance among basic secondary school students in post-covid-19 era in Obudu LGA of Cross River State, Nigeria. Ife Journal of Behavioural Research, 10(1): 112-123.

Shirley, L., 2008. Recent Development in Mathematics in Nigeria: Fourth International congress on mathematics Education, University of California.