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EFFECT OF RECIPROCAL PEER TUTORING STRATEGY ON ACHIEVEMENT IN MATHEMATICS FOR CONFLICT RESOLUTION AMONG SENIOR SECONDARY SCHOOL STUDENTS IN EBONYI STATE

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Abstract
This study sought to explore the effect of reciprocal peer tutoring strategy on achievement in Mathematics for conflict resolution among senior secondary school students in Ebonyi State. The study adopted a pre-test, post-test, control group using 2x2x2 factorial matrix. The design for this study was a non-equivalent pretest-posttest control group design. Two research questions and two null hypotheses guided the study. The sample comprised 32 SS2 students with low achievement in Mathematics drawn from two co-educational secondary schools in Ebonyi State with low mathematics achievement in 2024/2025 academic session. The treatment group was exposed to Reciprocal Peer Tutoring Strategy; while the control group was taught with conventional lecture teaching method. One instrument titled "Mathematics Achievement Test (MAT)" was developed by the researcher for the study. The instrument was validated by three experts. Kudar-Richardson -21 was used to determine the reliability of Mathematics Achievement Test (MAT) and reliability index of 0.79 was obtained for MAT. Data obtained were organized and analyzed using mean scores and standard deviation to answer the research questions and the null hypotheses were tested using analysis of covariance (ANCOVA) at 0.05 level of significance. The study revealed the following findings: Intervention using reciprocal peer tutoring strategy significantly improved achievement in Mathematics for conflict resolution. The mean Mathematics achievement scores of male and female low achievers did not significantly differ based on exposure to reciprocal peer tutoring strategy. It was thus recommended that teachers should be taught how to help students acquire skills required in the use of reciprocal peer tutoring strategy for conflict resolution.

Key: Reciprocal peer tutoring strategy, Achievement in Mathematics, Conflict resolution, Senior secondary school students

Introduction

Mathematics is one of the core subjects in the Nigerian educational curriculum in secondary schools which can help in conflict resolution. This is because a person who trains him or herself in critical thinking is more likely to reason logically and take decisions that lead to conflict resolution. Mathematics is a general requirement for admission into courses in tertiary institutions which stipulated at least five credit passes including English language and Mathematics (Ohakwe, 2017). However, many students have been denied admission into tertiary institutions as a result of their failure to credit Mathematics and many students have been denied promotion to the next class as a result of failure in Mathematics and or English Language. This shows how important Mathematics is in the secondary school system and the development of the nation.

Mathematics is a science of quantity and space. It is a body of knowledge that centers on such concepts as quantity, structure, space and change; and also a discipline that studies them (Marsh & Hou, 2023). Mathematics is regarded as a necessary tool for effective functioning in any society, and the foundation for all science and technological development. The study of Mathematics in secondary schools is necessary in building up basic skills and competencies needed for scientific and technological development and conflict resolution (Ohakwe, 2017).

Mathematics is an intellectually stimulating subject that permeates every aspect of human endeavour such as politics, economy, science and technology (Salman, 2015). Mathematics has become a veritable and indispensable tool in national development. Nigerian government made Mathematics a core subject in the school curriculum both in primary and secondary school levels as contained in the National Policy on Education (FRN, 2014). This is aimed at achieving Mathematics literacy, logical thinking and abstract thinking needed for successful living and problem solving.

Despite the relevance of Mathematics in national development, there have been persistent poor achievements in Mathematics in the Senior Secondary Certificate Examinations (SSCE) in Ebonyi State. Academic achievement was defined by Scott (2022) as how well a student has accomplished his or her task and studies. Achievement is a success in a task or undertaking while academic achievement is a learning outcome of the child. Academic achievement is a level of academic achievement that is exhibited by an individual in a learning task. This includes knowledge, skills and ideas acquired and trained through the course of the study within and outside classroom situation. This could be quantified by measurement of the child's academic standing in relation to those of other children of the child's age. In this study, low achieving students in Mathematics may be taken as those students who consistently perform below criterion referenced average. By this one means those who consistently achieve below 50 percent. Their low performance may not be due to any neuro-pathological cause but may be attributed to some environmental factors such as school, family, social factors, and the learners' behaviour such as passivity, withdrawal, limited initiative, low attention span and school maladjustment. According to Barrett and Trevitt (2021), the low achievers' feeling of insecurity may appear to be excessive and detrimental to their learning. These low achievements have been confirmed by the recent West African Examinations Councils' (WAEC) Chief Examiners' Reports for the years 2020 to 2024. These reports indicated that only 49.98%, 54.18%, 55.24%, 51.7% and 46.36% of the candidates who sat for the examinations obtained credits in Mathematics, which is basic requirement for admission into science and technology courses in Nigerian universities (WAEC, 2020-2024). These uninspiring achievements in Mathematics in the SSCE examinations are causes for concern. All these go to a large extent to reveal that poor achievement in Mathematics is a major problem that should be addressed.

Researchers such as Ayotola (2017), Ezenwa (2023) have made several efforts to diagnose the problems of Mathematics and proffer a lasting solution to the poor achievements in the subject. Suggestions have been made regarding the identification of teaching methods and learning strategies to make the study of Mathematics interesting and improve students' achievements in it. Also, the federal and state governments as well as some cooperate organizations, recognizing the fundamental role of Mathematics in economic development, have established different programmes to improve students' cognitive and affective outcomes in Mathematics. For example, the Federal Government established the National Mathematics Centre (NMC) in 1989 and the Mathematics Improvement Project in Akure in 2007 to develop and deploy appropriate initiatives and resources of international standing to rekindle and sustain interest in the study of Mathematics and Mathematical sciences at all levels. In spite of these efforts, the achievements of students in Mathematics are yet to improve to satisfactory level. Parents, teachers, curriculum experts and other stakeholders in education industry are worried about this poor achievement in Mathematics among students, especially when the current unsatisfactory state has been largely blamed on the predominant conventional method of teaching which is largely lecture method (Oloyede & Ojo, 2016).

Research trends outside Nigeria tend to suggest that reciprocal peer tutoring strategy has the potentials to increase students' learning outcome in Mathematics. According to Esteve (2015), reciprocal peer tutoring (RPT) could be defined as a learning situation where students take turns acting as the tutors and the tutees for instruction or review of academic material. In this case, students exchange roles during tutoring session, both giving and receiving academic assistance while the teacher supervises rather than participate in the intervention. The students dialogue among themselves as each learner acts in response to another. The dialogue is usually structured by the use of four strategies, sometimes known as the Fabulous Four (Oczkus, 2023), which are predicting, clarifying, questioning and summarizing. The goal of reciprocal peer

tutoring is to use discussion to enhance students' problem solving skills, develop self-regulatory and monitoring skills, and achieve overall improvement in motivation (Allen, 2023).

Reciprocal peer tutoring (RPT) is based on Vygotsky's (1978) social cognitive theory which emphasizes the role of social interaction (dialogue) in the development of cognition. Vygotsky believed that thinking aloud and discussion of thoughts aid clarification and revision of thinking and learning. Vygotsky's theory of Zone of Proximal Development (ZPD) is believed to be critical in identifying appropriate text and scaffolding activities to support student success (Gallowey, 2021). Vygotsky (1978: 86) explained ZPD to mean "…the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers". Though reciprocal peer tutoring strategy has some research evidence in support of its potential effectiveness in improving achievement in some parts of Western Europe, (Allen, 2023; Oczkus, 2023), little studies seem to be available here in Nigeria. Therefore, it is important that this strategy be tried out in Ebonyi State to determine the extent of its effectiveness in improving the achievement in Mathematics among secondary school students.

In adopting reciprocal peer tutoring strategy, gender is a factor that is suspected to influence achievement of students. Walter (2023) defined gender as a social umbrella that reveals the relationship, influence, role, attitude, behaviour and reactions which occur between male and female sexes. Gender could be defined as a social construct which explains the roles males or females undertake in a given society. However, the researcher operationally defined gender as a social and cultural construct that explains the roles of either male or female in a society. In a study conducted by Godpower and Ihenko (2021), it was indicated that males were more dominant in choosing sciences and technical courses in external examination in Rivers State than the female counterparts. The argument from the previous study revealed that males are

more likely to use the right hemisphere of the brain for spatial thinking than the females who may use the left hemisphere of the brain for verbal reasoning. The findings of this study would reveal which gender has higher achievement in Mathematics among low achieving students as a result of exposure to reciprocal peer tutoring strategy in Ebonyi State.

Statement of the Problem

Mathematics is indispensable in life because no meaningful development can take place in a nation without adequate training of young people in natural science especially in Mathematics. Mathematics has been shown to be a very important tool for effective functioning in any society for conflict resolution, and the foundation for all science and technological development. It is a core instrument used to understand and further explore the world.

However, the prevailing problem in Nigeria is that the achievements of students in Mathematics in the Senior Secondary School Certificate Examinations have been declining steadily. This poor academic achievement of students in Mathematics, could be attributed to the teaching methods adopted by the Mathematics teachers. These Mathematics low achieving students consistently perform below criterion referenced average. This situation has attracted the concern of teachers, parents, curriculum experts and evaluators; especially when all the recommended Mathematics teaching and learning strategies seem to have failed to yield the expected results. If the achievements of students in the SSCE Mathematics remain as poor as this, it may affect both the economic and technological development of Nigeria.

Research trends outside Nigeria tend to suggest that reciprocal peer tutoring strategy has the potential to increase learning outcome in Mathematics for conflict resolution. How reciprocal peer tutoring strategy would affect the achievement in Mathematics for conflict resolution of Nigerian students who operate in different socio-cultural circumstances is yet to be determined. Therefore, the problem of this study put in a question form is: How would

reciprocal peer tutoring strategy affect the achievement in Mathematics for conflict resolution among Senior Secondary class II students in Ebonyi State?

Purpose of the Study

The purpose of the study was to determine the effects of reciprocal peer tutoring strategy on achievement in Mathematics for conflict resolution among Senior Secondary students in Ebonyi State. Specifically the study sought to:

1. determine the difference in the Mathematics achievement mean scores of low achievers exposed to reciprocal peer tutoring strategy and those taught using the lecture teaching method at posttest.
2. determine the extent to which the mean Mathematics achievement scores of male and female low achievers differ based on exposure to reciprocal peer tutoring strategy.

Research Questions

The following research questions guided the study:

1. What is the difference in the Mathematics achievement mean scores of low achievers exposed to reciprocal peer tutoring strategy and those taught using the lecture teaching method at posttest?
2. What is the extent to which the mean Mathematics achievement scores of male and female low achievers differ based on exposure to reciprocal peer tutoring strategy?

Hypotheses: -

The following hypotheses were formulated and tested at 0.05 levels of significance:

HO_1: There is no significant difference in mean Mathematics achievement scores of low achievers exposed to reciprocal peer tutoring strategy and those taught using lecture teaching method.

HO_2: The mean Mathematics achievement scores of male and female low achievers do not significantly differ based on exposure to reciprocal peer tutoring strategy.

Methodology

The study adopted a pre-test, post-test, control group using 2x2x2 factorial matrix. The specific design for this study was a non-equivalent pretest-posttest control group design. Two research questions and two null hypotheses guided the study. The sample for this study comprised 32 identified SS2 students with low achievement in Mathematics (16 males and 16 females) which was drawn from two intact classes in two co-educational secondary schools in Ebonyi State through multistage sampling technique from a total population of 1114 students (487 males and 627 females) identified secondary class two students with low mathematics achievement in 2024/2025 academic session (States Secondary Education Management Board, 2025). There was one experimental group and a control group. The treatment group was exposed to Reciprocal Peer Tutoring Strategy; while the column is represented by gender (male and female) as moderator variables for the study. The two schools were assigned to the treatment and control conditions. One instrument titled "Mathematics Achievement Test (MAT)" was developed by the researcher for the study. The instrument was validated by three experts, one specialists in Mathematics, one expert in Psychology and one expert in Measurement and Evaluation, all from Michael Okpara University of Agriculture, Umudike. Kudar-Richardson -21 was used to determine the reliability of Mathematics Achievement Test (MAT) and reliability index of 0.79 was obtained for MAT. Data obtained through the administration of the MAT by the regular Mathematics teachers who served as the research assistants were organized and analyzed using mean scores and standard deviation to answer the research questions and the null hypotheses were tested using analysis of covariance (ANCOVA) at 0.05 level of significance.

Results

Research question 1: What is the difference in the Mathematics achievement mean scores for conflict resolution of low achievers exposed to reciprocal peer tutoring strategy and those taught using the lecture teaching method at posttest?

Table 1: Pretest-Posttest Mean Mathematics Achievement Scores and Standard Deviation of Low Achievers Exposed to Reciprocal Peer Tutoring Strategy and those Taught Using the Lecture Teaching Method at Posttest

Groups	Source	Pre-Test	Post Test	Mean gain	Mean gain diff.
Experimental group	Mean	45.00	75.00	30.00	
	N	16	16		
	SD	26.00	36.00		25.00
Control group	Mean	40.00	45.00	5.00	
	N	16	16		
	SD	27.00	35.00		

Data in Table 1 showed the Mathematics achievement mean scores of low achievers exposed to reciprocal peer tutoring strategy and those taught using the lecture teaching method at posttest. From the data, one can see that the participants in the experimental group had a pretest mean score of 45.00 and standard deviation of 26.00 in their Mathematics achievement test; while their post-test means Mathematics achievement score was 75.00 with a standard deviation of 36.00; giving a mean pre-test/post-test gain score of 30.00. The participants exposed to lecture teaching method (control group) had a pretest mean mathematics achievement score of 40.00 with a standard deviation of 27.00 while their post-test mean score was 45.00 with a standard deviation of 35.00; giving a prêt-test/posttest mean gain score of 5.00. The experimental group that was exposed to reciprocal peer tutoring strategy had a higher mean point gain score than the participants in the control group with a higher mean gain difference of 25.00. The standard deviation of the two groups ranged between 26.00 and 36.00; indicating that the respondents were not too far from the mean and from one another in their responses, adding further validity to the mean.

Hypothesis One: There is no significant difference in mean Mathematics achievement scores for conflict resolution of low achievers exposed to reciprocal peer tutoring strategy and those taught using lecture teaching method.

Table 2: Summary of the 2-Way Analysis of Covariance of Participants on Mean Mathematics Achievement Scores for Conflict Resolution of Low Achievers Exposed to Reciprocal Peer Tutoring Strategy and those Taught Using Lecture Teaching Method

Source	Type III sum of squares	Df	Mean square	F	Sig
Corrected model	13250.211[a]	4	3312.553	83.507	.000
Intercept	3936.737	1	3936.737	99.242	.000
Pre-Achiev.	34.659	1	34.659	.874	.174
Treatment	12634.952	1	12634.952	318.517	.000
Error	1071.039	27	39.668		
Total	204701.000	32			
Corrected Total	16321.250	31			

a R squared =812 (Adjusted R square = .807)

The data in the Table 2 indicated that reciprocal peer tutoring strategy as a factor in the study has a significant effect on the Mathematics achievement of the participants. This is because the calculated F-valve of 318.517 in respect of the treatment as main effect of reciprocal peer tutoring strategy on mean Mathematics achievement scores is higher than f-critical of 1.96 with degree of freedom of 4 and 27 at 0.05 level of significance. This implies that exposing students to reciprocal peer tutoring strategy during Mathematics instructions significantly increased their Mathematics achievement. Therefore the null hypothesis of no significant difference in mean Mathematics achievement scores of low achievers exposed to reciprocal peer tutoring strategy and those taught using lecture teaching method was rejected. Thus, there was significant difference in the mean Mathematics achievement scores of low achievers exposed to reciprocal peer tutoring strategy and those taught using lecture teaching method.

Research question 2: What is the extent to which the mean Mathematics achievement scores for conflict resolution of male and female low achievers differ based on exposure to reciprocal peer tutoring strategy?

Table 3: Pretest-Posttest Mean Mathematics Achievement Scores and Standard Deviation of Male and Female Low Achievers Exposed to Reciprocal Peer Tutoring Strategy at Posttest

Groups	Source	Pre-Test	Post Test	Mean gain	Mean gain diff.
Male	Mean	45.00	75.00	30.00	
	N	8	8		
	Std. Deviation	26.00	36.00		5.00
Female	Mean	40.00	65.00	25.00	
	N	8	8		
	Std. Deviation	27.00	35.00		

Data in Table 1 showed the Mathematics achievement mean scores of male and female low achievers exposed to reciprocal peer tutoring strategy at posttest. From the data, one can see that the male participants in the experimental group had a pretest mean score of 45.00 and standard deviation of 26.00 in their Mathematics achievement test; while their post-test means Mathematics achievement score was 75.00 with a standard deviation of 36.00; giving a mean pre-test/post-test gain score of 30.00. The female participants in the experimental group had a pretest mean score of 40.00 and standard deviation of 27.00 in their Mathematics achievement test; while their post-test means Mathematics achievement score was 65.00 with a standard deviation of 35.00; giving a mean pre-test/post-test gain score of 25.00. The male participants had a higher mean point gain score than the female participants with a higher mean gain difference of 5.00.

Hypothesis Two

The mean Mathematics achievement scores for conflict resolution of male and female low achievers do not significantly differ based on exposure to reciprocal peer tutoring strategy.

Table 4: Summary of the 2-Way Analysis of Covariance of Participants on Mean Mathematics Achievement Scores and Standard Deviation of Male and Female Low Achievers Exposed to Reciprocal Peer Tutoring Strategy at Posttest

Source	Type III sum of squares	Df	Mean square	F	Sig
Corrected model	13250.211[a]	4	3312.553	34.021	.000
Intercept	3936.737	1	3936.737	40.432	.000
Pre-Achiev.	34.659	1	34.659	.356	.174
Treatment	12634.952	1	12634.952	129.766	.000
Gender	20.841	1	20.849	.214	.064
Error	1071.039	11	97.367		
Total	204701.000	16			
Corrected Total	16321.250	15			

a R squared =812 (Adjusted R square = .807)

The data in the Table 4 indicated that gender as a factor in the study has no significant effect on the Mathematics achievement of the participants. This is because the calculated F-valve of 0.214 in respect of the treatment as main effect of reciprocal peer tutoring strategy on mean Mathematics achievement scores is less than f-critical of 1.96 with degree of freedom of 4 and 11 at 0.05 level of significance. This implies that the mean Mathematics achievement scores of male and female low achievers did not significantly differ based on exposure to reciprocal peer tutoring strategy. Therefore the null hypothesis of no significant difference in mean Mathematics achievement scores of male and female low achievers exposed to reciprocal peer tutoring strategy was retained. Consequently, both male and female low achievers exposed to reciprocal peer tutoring strategy benefitted equally from the treatment for conflict resolution.

Discussion of Findings

The findings of this study revealed that intervention using reciprocal peer tutoring strategy significantly improved students' Mathematics achievement. The students taught mathematics using reciprocal peer tutoring strategy had higher post-test Mathematics achievement mean score than those students taught using lecture teaching method. This result is in support earlier research findings of Okonkwo (2020) and Shihusa and Keraro (2020).

The study by Okonkwo (2020) showed that reciprocal peer tutoring strategy had significant effect on students' achievement in Physics. It enabled the teacher to teach the students the relationship between past learning and present learning which enhanced learning of principles and problems solving of the identified areas of deficiency. The study by Shihusa and Keraro (2020) also reported that students who were taught using reciprocal peer tutoring strategy were highly motivated and achieved higher than those taught using traditional method. The similarity between the findings of the present study and earlier studies confirm the efficacy of reciprocal peer tutoring strategy in enhancing the achievement of students in Mathematics for conflict resolution. The findings of this study revealed that the mean Mathematics achievement scores of male and female low achievers did not significantly differ based on exposure to reciprocal peer tutoring strategy. This implies that both male and female participants exposed to reciprocal peer tutoring strategy benefited uniformly. The findings of this study are in agreement with the findings of a study conducted by Bassey and Asim (2021) which revealed gender equality in the entire sample as well as among the low socio economic students and within public schools. The findings of this study also agree with the findings of a study that was conducted by Buttler (2023) to find out the effect of reciprocal peer tutoring strategy on the achievement of male and female secondary school students with learning disabilities. The findings of the study revealed among others that reciprocal peer tutoring strategy is efficacious in improving consistent poor achievement and self-efficacy with no significant gender differences. Deduction could be made therefore, that the differences in achievement that exist between male and female students in some other studies could often be as a result of quality of instruction and not any biological disposition. There was no significant gender difference in the present study because both male and female participants were exposed to the treatment using reciprocal peer tutoring strategy without gender discrimination for conflict resolution.

Conclusions

The following conclusions are made based on the findings and discussions of the study:

1. The use of reciprocal peer tutoring strategy in teaching Mathematics significantly enhanced the Mathematics achievement of low achievers for conflict resolution. This conclusion is based on the findings of this study which revealed a significant difference in Mathematics achievement of the participants exposed to reciprocal peer tutoring strategy during instruction and those exposed to conventional lecture method.
2. Gender as a factor in the study had no significant influence on the Mathematics achievement mean scores of low achieving students who were exposed to reciprocal peer tutoring strategy. Therefore, reciprocal peer tutoring strategy teaching-learning environment minimizes gender effect on students' Mathematics achievement especially because of the active involvement of both male and female low achieving students in Mathematics without gender discrimination. for conflict resolution

Recommendations

Based on the findings and educational implications of this study, the following recommendations are made.

1. Students should be exposed to reciprocal peer tutoring strategy during instruction, so that they will apply the strategy in learning process for conflict resolution.
2. Stakeholders in education; the federal and state government, education management boards and schools administrators should organize in-service training, workshops and seminars for both the teachers and students on these effective strategies and effective use of the RPT strategy.

3. Male and female students should be exposed to unbiased learning environment of mathematics, so that they will have equal opportunities to learn and apply the learning strategy in their learning tasks for conflict resolution.

References

Allen, S. (2023). An analytic comparison of three models of reading strategy instruction. *IRAC: International Review of Applied Linguistics in Language Teaching* 41(4), 319-339.

Ayotola, A. (2017). Effects of games on mathematics achievement of low ability pupils in Nigerian primary schools. *Institute Journal of Studies in Education.* 1 (1), 36-41

Barrett, H., & Trevitt, P. (2011). *Development throughout the lifespan (3rd Ed).* Boston: Allyn & Bacon.

Baasey, H. & Asiam, P. (2011). *Development throughout the lifespan (3rd Ed).* Boston: Allyn & Bacon.

Butler, D. H. (2013*).* Promoting strategic content learning by adults with learning disabilities: An alternative approach. (Doctorial dissertation Simo Fraser University, Bumby). Retrieved from *www.eric.ed.gov/ERICWebportal/recor*...

Esteve, B. M. (2015). Reciprocal peer tutoring and treatment integrity of elementary school students. An *M. A Thesis* Louisiana State University.

Ezenwa, H. C. (2023). Effect of advance graphic organizer and problem based learning strategies on interest and achievement in mathematics among senior secondary school students in Abia State. *Unpublished Ph.D Dissertation*. Michael Okpara University of Agriculture, Umudike

Federal Republic of Nigeria. (2014). *National policy on education.* Lagos: Federal Government Press.

Galloway, C. A. (2021). Vygotsky's learning theory. In M. Orey (Eds) Emerging perspectives on learning, teaching and technology. *Journal of Instructional Psychology of Exceptionality, 3,* 465 – 478

Godpower, E. G.; & Ihenko, S. (2021). Influence of gender on mind-mapping learning method, interest and academic achievement of low I.Q students in inter science in Obio Akpor L.G.A of Rivers State. *European scientific Journal, 13 (10), 213-223.*

Marsh, H. W. & Hau, K. (2023). Big fish little-pond effect on the academic self-concept: Across-cultural (26-country) test of the negative effects of academically selective schools. *American Psychologist*, 58, 364-376.

Oczkus, L. (2023). Reciprocal teaching at work: Strategies for improving reading comprehension. Nemark, D. E: International Reading Association.

Ohakwe, E. U. (2017). *Secondary school students' mathematics achievement as a determinant of learning outcomes among pre-service teachers in Zamfara State. Global Journal of Educational Research*. 9 (1), 11-27.

Okonkwo, A.C. (2020).Effectiveness of using advance verbal organizer as a remediation strategy on students' academic achievement in physics among Aba students. *Global Journal of Educational Research*. 9 (1), 11-27

Salman, M.F. (2015). *Effect of a pre-instructional strategy on teaching and learning of selected mathematical concepts at senior secondary school level. American Educational Psychologist*, 26: 207- 231

Scott, K. (2012). Cognitive maps in rat and man. *Psychological Review*. 152: 126- 143

Shihusa, H. & Keraro, F.N. (2020). Using advance organizer s to enhance students' motivation in learning biology. *Eurisia Journal of Mathematics, Science and Technology Education* 5 (4), 413-420.

Vygotsky, L. S. (1978). Mind in society: The development of higher psychological processes. Cambridge, MA: Harvard University Press. Retrieved September 28, 2008 from *http://coe.ksu.edu/jecdo/vol.3/articles/wang.htm*.

Walter, D.M. (2023). Motivation of students in physics education through mind-mapping and effective questioning method. Contemporary issues. Benin: Alfrel Press

West African Examination Council (2020-2024). *Chief examiner's report.* Lagos: WAEC