Motivation as Correlate of Slow Learners' Achievement in Modular Arithmetic in Senior Secondary School Mathematics

[1]Gladys Njideka Okpalanwa, *[1]Chika C. Ugwuanyi, and [2]Ann O. Ugwuda

[1]Department of Science Education, Faculty of Education University of Nigeria, Nsukka

[2]Department of Statistics, Federal Polytechnic, Oko, Anambra State

*Corresponding Author

ABSTRACT

The study investigated the relationship between motivation and academic achievement of slow learners in modular arithmetic in senior secondary school mathematics in Orumba South Local Government Area of Anambra State. Two research questions and two null hypotheses guided the study. The study adopted a correlational research design. The population of the study was all the 726 (361 male 365 female) senior secondary school one (SS1) students in Orumba South Local Government Area in Anambra State. The sample size was the identified 127 (59 male and 68 female) slow learners purposively selected from seven (7) randomly sampled secondary schools in the study area. The instruments used for data collection were Modular arithmetic Academic Motivation Inventory (MAMI), and Modular arithmetic Achievement Test (MAAT). These instruments were validated by three experts in the field. The reliability index of MAMI was gotten as 0.84 using Chronbach Alpha and that of MAAT was obtained as 0.75 using Kuder Rechardson 20 (K-R20). Data collected were analyzed using Regression Analysis in answering all the research questions and Analysis of Variance Regression Analysis for testing the null hypotheses at 0.05 levels of significance. The findings of the study revealed a significant high positive relationship between motivation and slow learners' academic achievement in modular arithmetic. It was also found that gender has no significant relationship between academic motivation and slow learners' academic achievement in modular arithmetic in senior secondary school Mathematics. The findings of the study were discussed and it was recommended among others that enough motivation should be given to slow learners to boost their self-confidence so as to achieve higher in Mathematics.

Keywords: Motivation, Correlate, Slow learners, Academic achievement and Modular arithmetic.

INTRODUCTION

Mathematics is very important in all the spheres of life. It is one of the core subjects in both primary and secondary education in Nigeria. Mathematics is the science and study of quality, structure, space, and change. Mathematicians seek out patterns, formulate new speculation, and establish truth by rigorous deduction from appropriately chosen principles and definitions (William, 2023). Nwigboji and Olo (2017) argued that mathematics is a fundamental tool that enables individuals to manage resources, make informed decisions, and engage effectively in various aspects of life. They highlight its importance in areas like business, finance, and everyday decision-making. The authors emphasize that mathematics is not just a subject for academics but a practical skill applicable to daily life.

Mathematics is a methodical application of matter. It is so because the subject makes a man methodical or systematic. Mathematics makes our life orderly and prevents chaos. Certain qualities that are nurtured by Mathematics are power of reasoning, creativity, abstract or spatial thinking, critical thinking, problem-solving ability and even effective communication skill (Biswas, 2015). Biswas continued by saying that mathematics is the cradle of all creations, without which the world cannot move an inch, be it a cook, or a farmer, a carpenter

or a mechanic, a shopkeeper or a doctor, an engineer or a scientist, a musician, everyone needs Mathematics in their day-to-day life.

The importance of mathematics as a requirement for scientific and technological development of any nation cannot be over-emphasized. No wonder, Mathematics education which is the teaching and learning of Mathematics with its associated scholarly research was described by Magaji et. al (2021) as a tool for becoming self-reliant, a tool for technological development and enhances sustainable development.

Despite the acknowledged importance of Mathematics in National development and in our everyday life, some students hate this subject because of the confusing agglomeration of numbers the teachers seem to conjure when they are teaching (Wahab, 2018). Wahab also said that the phobia for mathematics among students is a universal phenomenon and this perhaps is the reason it is almost universally believed that this subject is very difficult and the hatred that some students have for this subject is attributable to their poor foundations in the subject. Many researchers have attempted finding out the causes of students' poor achievement in Mathematics which include the following as found out by many authors: poor teaching methods applied to teach mathematics, inadequate instructional materials, students' misconception of mathematics as a difficult subject, Mathematics teachers' attitude towards teaching this subject, poor teaching skills/strategies and lack of participation by the students, among others could be responsible for students' poor achievement in the subject (Ayebale, Habaasa, & Tweheyo, 2020). Therefore it is clear that the causes of poor achievement in mathematics among secondary school students are many and varied but they fall under school based causes, teachers' and students' personal causes. This shows that mathematics education at secondary school level is problematic resulting to poor students' achievement especially as it concerns the newly introduced concepts in General Mathematics among which is Modular arithmetic. Modular arithmetic is among the concepts that were introduced by National Education Research and Development Council (NERDC) in 2007 along with other concepts like: Matrices and determinants, differentiation and integration of simple algebraic functions and logical reasoning.

Modular arithmetic is a system of arithmetic for integers which considers the remainders. According to Odogwu et al, (2015), modular arithmetic is operation which gives remainder when an integer is divided by a fixed non-zero integer. When one divides an integer by 7, all the possible remainders are, 0, 1, 2, 3, 4, 5 and 6. These values become the elements of modulo 6. The set of z of integers is shown as $z = \{0, 1, 2, 3, 4, 5, 6\}$. The divisor is modulus, and the process is arithmetic modulo of 7. The operations involving addition, subtraction, multiplication and division can be carried out using modulo arithmetic. Examples; sum up 8 and 13 in modulo 6. Now, when 8 and 13 are added together, we get 21 and 21 is written as 3 x 6 rem 3. The solution is 3 (mod) 6. We follow the same process in subtraction, division and multiplication.

In Modular arithmetic, numbers "wrap around" upon reaching a given fixed quantity, which is known as modulus (which would be 12 in the case of hours on a clock, or 60 in the case of minutes or seconds on a clock). Modular arithmetic is also referred to as arithmetic of congruencies, sometimes known informally as "clock arithmetic" (Insall and Weisstein, 2019). Modular arithmetic is concerned with congruent relations. Before stating what congruence relation involves, recall that given a positive integer K, it would divide an integer b resulting in an integer n and another integer r usually called the remainder that is b $\equiv n \times k + r$.

This topic in mathematics called modular arithmetic is one of the concepts of mathematics newly introduce into the curriculum in the year 2007 by the Federal Ministry of Education (FME), senior secondary National Education Research and Development Council (NERDC). The importance of modular arithmetic to students and society are many and these include: time keeping as in module 12 arithmetic, the algorithm that determines a market day in the community as in module 5 arithmetic, the algorithm that determines the day of the week for a given date as in module 7, the modular operation as implemented in programming language and calculations and others (Awodeyi, 2017). It is because of this importance of modular arithmetic that it is included in the curriculum.

Regardless of the acknowledged importance of this Modular arithmetic, there is evidence of students' poor achievement in this concept and Mathematics in general at secondary school level. There are evidences that many students have low achievement in Modular arithmetic as contained in the chief examiners' report from

West African Examinations Council (WAEC, 2011;, 2013). The poor achievement in Modular arithmetic may also be a reason for the overall poor achievement of students in Mathematics in general as can be seen in the annual result analyses of most public secondary schools in Orumba South Local Government Area of Anambra State

Due to all these importance of Modular arithmetic, Mathematics teachers therefore have the professional responsibility to help, develop and boost the achievement of all the students especially the slow learners who may not learn at the same pace with other students in this all-important useful concept – modular arithmetic.

Slow learners tend to perform at their ability level, which is below average. A slow learner is one who has the ability to learn necessary academic skills but at a rate and depth below average of the same age peers (Suranjana, Ujjani and Kanti, 2015). The students whose cognitive structures are low are referred to as slow learners (Vasudevan, 2017). The slow learners need more efforts to understand a concept that has been mastered by the majority of students in the class. This is in accordance with Novitasari, Lukito and Ekawati's opinion (2018) which reveals that the slow learners has below average cognitive abilities of the age mates and struggle to cope with the traditional academic demands of the regular classroom. According to Suranjana, Ujjani and Kanti (2015), the slow learners exhibit the following characteristics: Low self-esteem, poor concentration skills, inattention in class, poor grades, procrastination in submitting assignments and their preference to work with their hands rather than theoretical learning.

However, slow learners must receive education because education is the right of every citizen, no exception, including children who have other learning difficulties whose thinking skills are below average than other normal students in his/her age. This is a big challenge for teachers to help slow learners build their understanding of learning mathematics in general class especially in learning modular arithmetic because even average students generally find it difficult and make errors in solving problems in it. Mathematics teachers therefore have the professional responsibility to help, develop and boost the achievement of all the students especially the slow learners who may not learn at the same pace with other students in this all important useful concept – modular arithmetic by employing good instructional strategies that will make their course deliveries more meaningful, effective, productive and understandable in modular arithmetic. Among those strategies that can be tried out, according to Dasaradhi, Rajeswari and Badarinath (2016) are; pair work, repetition, time-on-task, manipulation of tools, motivation, mathematics games and others. The present researcher picks motivation as instructional strategy that can be employed and hence investigate if it can help the slow learners to achieve higher.

Motivation is the reason or reasons why people act or behave in a particular way. This is to say that motivation is an urge to behave or act in a way that will satisfy certain conditions such as wishes, desires or goals. Psychologists believe that motivation is rooted in a basic impulse to optimize wellbeing, minimize physical pain and maximize pleasure (Lumenlearning, 2019). Motivation refers to the process in which motive drives an individual towards an action (Study and Exam, 2018). Study and Exam views motive as a goal, an aim, ambition, a need, a want, an interest, a desire that motivates an individual towards action. Additionally, motivation is seen as the inner desire to do what is expected to be done even when the person does not feel like doing that. Motivation can be intrinsic or extrinsic.

Intrinsic motivation is a type of motivation in which the motives originate from inside the human body. It refers to the internal driving state stimulating an individual to behave in a specific way. It includes biological desires such as hunger, thirst, sleep, relief from pain, temperature regulation and so on (Study and Exam, 2018). For example, the hunger is driving force coming from inside to compel an individual to eat food. Similarly, after doing all day activities, the individual feels tired and requires a good amount of sleep to relax for the next day. Our curiosity, internal fears, psychological needs and desires also serve as intrinsic motives.

Extrinsic motivation is a type of motivation in which the motives originate from outside the human body. The driving force exists outside the human body that stimulates the individual for certain actions. Though these motives are external to the human body but they have a rewarding or punishment impact for the individual. It includes the following motives; incentives, bonuses, allowances, promotion and demotion, reward and punishment, merit and distinction certificates, appreciation certificates and prizes (Study and Exam, 2018). In a

nutshell, students are intrinsically motivated if they love or enjoy what they are doing even if there is no reward or incentive for it while students are extrinsically motivated if they do not enjoy what they do; they will do so to obtain the rewards or tokens (Borderless, 2017). Borderless further maintained that motivation uplifts students' enthusiasm (slow learners as in the case of this study) about the activities presented to them once they get motivated to achieve something by doing the tasks, they will eventually exert their full effort, time, and energy, in this way they become determined or persistent in accomplishing things even those that are not of their interest. From the above statements, if slow learners are given attention and encouragement through motivation, they may feel belonged and carried along and this may spur them to action and hence achieve higher

Another variable of interest in the present study is gender and its influence on the achievement of students (slow learners inclusive) in Modular arithmetic. Gender refers to the socially constructed characteristics of women and men, such as norms, roles, and relationships of and between groups of women and men. It varies from society to society and can be changed (WHO, 2019). This is against sex which tends to relate to biological differences. For instance, male and female genitalia, both internal and external are different. Similarly, the levels and types of hormones present in male and female bodies are different. So, it is only genetic factors that define the sex of an individual.

Most of the researchers are showing that there exists no gender difference among their studies so far but one still wonders why the under-representation of women at the highest level of mathematics, physical sciences and engineering (Breda, Jouini & Napp, 2023).This study therefore investigated gender differences in slow learners' achievement in Modular arithmetic. This is because of the varying reports on studies in gender differences in students' achievements in mathematics. It is against this inconclusive background that the present study aims at investigating the influence of gender on slow learners' achievement in modular arithmetic. In a bid to attest to the above belief and support existing finding by aforementioned researchers, this present study is geared towards investigating how motivation correlate with slow learners' achievement in modular arithmetic.

Statement of the Problem

Mathematics being one of the compulsory subjects which students must offer and pass at credit level at secondary level of education and as a pre-requite for useful living within the society and for higher education needs to be given more serious attention.

Despite the importance of mathematics, there is still evidence of poor achievement of students in general and slow learners in particular in mathematics especially in modular arithmetic due to the fact that modular arithmetic is newly introduced in the school curriculum. The slow learners who are seen as pace disabled find it difficult to learn with the average students in the class. The researcher is seeing these difficulties to learn by the slow learners as a function of the teaching strategies used in teaching the new concept so that the slow learners can easily understand. This prompted the researcher to begin searching for alternative teaching strategies for these particular secondary school slow learners due to the needy, desperate and sad looking on students' faces as they were unable to follow the lessons being taught which may invariably affect their achievements. Therefore, there is need to explore alternative teaching strategies and then their relationship with slow learners' achievement in modular arithmetic. Hence, the problem of this study put in question form is; what is the relationship between motivation and slow learners' academic achievement in senior secondary school modular arithmetic?

Purpose of the Study

The purpose of this study was to determine the relationship between motivation and academic achievement of secondary school slow learners' in modular arithmetic. In specific terms, the study determined the;

1. relationship between motivation and slow learners' academic achievement in modular arithmetic in senior secondary school mathematics

2. relationship between motivation and slow learners' academic achievement in modular arithmetic in senior secondary school mathematics as moderated by gender.

Research Questions

The following research questions were formulated to guide the study.

1. What is the relationship between motivation and slow learners' academic achievement in modular arithmetic in senior secondary school mathematics?

2. What is the relationship between motivation and slow learners' academic achievement in modular arithmetic in senior secondary school as moderated by gender?

Hypotheses

HO1. There is no significant relationship between motivation and slow learners' academic achievement in modular arithmetic in senior secondary school mathematics.

HO2. There is no significant relationship between motivation and slow learners' academic achievement in modular arithmetic in Senior Secondary school mathematics as moderated by gender.

METHODS

The study adopted a correlational survey research design. A correlational research is a type of non-experimental research method in which a researcher measures two variables, understand and assess the statistical relationship between them with no influence from any extraneous variables (Bhat, 2019). Also, according to Nworgu (2015), correlational survey study is the type of study that seeks to establish the nature of relationship that exists between two or more variables. The design was considered appropriate for the study because the study will establish the nature of relationship that exist between the criterion variable (slow learners' achievement in modular arithmetic) and the predictor variable (motivation).

The study was carried out in the Secondary Schools in Orumba South Local Government Area, Anambra state of Nigeria. Orumba South Local Government Area was chosen for the study because it has been recorded over the years that the secondary school students in this local government area score low in Mathematics in their annual results. Their consistent poor grades in Mathematics is an eye opener that there may be greater number of slow learners in that local government area as one outstanding characteristics of slow learners is that they always achieve poorly in both standard and teacher made test.

The population for this study comprised all the 726 (361 male and 365 female) Senior Secondary one (SSI) students from (14) public secondary schools in Orumba South Local Government Area for 2020/2021 session. The sample size for this study was all the identified 127 (59 male and 68 female) slow learners in the intact class purposively selected from seven (7) schools randomly drawn from Orumba south local government area, Anambra state. To identify the slow-learners, the researchers gave aptitude test to the intact class in the different schools where all the students were given identification numbers which they wrote on their papers. This was marked out of 100% and those that scored less than 40% were fished out as slow learners.

The instruments used for data collection for this study were Modular Arithmetic Academic Motivation Inventory (MAMI) and Modular Arithmetic Achievement Test (MAAT). MAMI contains 23 items which measured the slow-learners' Modular arithmetic academic motivation. The MAMI was measured on a four point rating scale of Strongly Agree (SA) - 4, Agree (A) - 3, Disagree (D) - 2 and Strongly Disagree (SD) - 1 for positively cued items and the reverse order, for negatively cued items. MAAT is a 40 item multiple-choice question with options A to D and was constructed using table of specification in order to assess the level of acquisition of the concept-Modular arithmetic by the slow learning students. The instruments MAMI and MAAT were face validated by three experts who also did the content validation of MAAT using the table of specification constructed. The reliability index of MAMI was gotten using Cronbach Alpha as 0.84 and that of

MAAT was obtained using Kuder Rechardson 20 (K-R20) as 0.75 making the two instruments suitable for the study.

The researchers with the help of research assistants administered the copies of the instruments MAMI and MAAT to the intact class of the sampled schools and thereafter the slow learners own were sieved out using their identification number, scored and used for the analysis. The data collected were analyzed with the help of Statistical Packages for Social Science (SPSS) version 25. This gave the regression analysis used in answering all the research questions and analysis of variance regression analysis that was used to test the null hypotheses at 0.05 level of significance.

RESULTS

The results below are presented according to the research questions and hypotheses that guided the study.

Research Question One

What is the relationship between motivation and slow learners' academic achievement in modular arithmetic in senior secondary school Mathematics?

Table 1: Regression analysis of the responses on the relationship between motivation and slow learners' academic achievement in modular arithmetic in senior secondary school Mathematics

Variables	r	R^2
Motivation and slow learners' academic achievement in modular arithmetic	0.74	0.56

(R^2) = Coefficient of Determination

The result in Table1 shows that the correlation coefficient between motivation and slow learners' academic achievement in modular arithmetic in senior secondary school Mathematics was 0.74. This means that, there exist a high positive relationship between motivation and slow learners' academic achievement in modular arithmetic in senior secondary school Mathematics. Table 1 also revealed that, the coefficient of determination (R^2) associated with the correlation coefficient of 0.74 was 0.56. This coefficient of determination (R^2) indicates that, 56% of variation in slow learners' academic achievement in modular arithmetic is attributed to motivation. This is an indication that 44% of the variation in slow learners' academic achievement in modular arithmetic is attributed to other factors other than motivation.

HO$_1$: There is no significant relationship between motivation and slow learners' academic achievement in modular arithmetic in senior secondary school Mathematics

Table 1: Regression Analysis of relationship between motivation and slow learners' academic achievement in modular arithmetic in senior secondary school Mathematics

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	201.761	1	201.761	10.716	.001[a]
	Residual	2353.594	125	18.829		
	Total	2555.354	126			

The result in Table 1 shows that an F-ratio of 10.716 with associated exact probability value of 0.001 was obtained. This probability value of 0.001 was compared with 0.05 set as level of significance for testing the hypothesis and it was found to be significant because 0.001 is less than 0.05. Thus, the null hypothesis which stated that; there is no significant relationship between motivation and slow learners' academic achievement in modular arithmetic in senior secondary school Mathematics was rejected. The researcher therefore, concludes that there is a significant relationship between motivation and slow learners' academic achievement in modular arithmetic in senior secondary school Mathematics

Research Question Two

What is the relationship between motivation and slow learners' academic achievement in modular arithmetic in senior secondary school Mathematics as moderated by gender?

Table 2: Regression analysis of relationship between motivation and slow learners' academic achievement in modular arithmetic in senior secondary school Mathematics as moderated by gender

Model	Gender	N	r	R^2	z-value	Sig
1	Male	59	.77	.59	.38	.70
2	Female	68	.74	.55		

Result in Table 2 revealed that the correlation coefficients (r) of .77 and .74 with associated coefficients of determinant (r^2) of .59 and .55 were obtained for male and female slow learners respectively between their motivation and academic achievement in modular arithmetic. The obtained coefficients of determinant of .59 and .55 indicate that 59% and 55% variation in slow learners' academic achievement in modular arithmetic in senior secondary schools mathematics is attributed to motivation for male and female slow learners' respectively. The difference in the variation of male and female slow learners as predicted by students' academic motivation is jointly 4% in favour of the male slow learners. Hence, gender moderated 4% of the variation in slow learners' academic achievement in modular arithmetic in favour of the males than their female counterparts.

Hypothesis Two

There is no significant relationship between motivation and slow learners' academic achievement in modular arithmetic in senior secondary school Mathematics as moderated by gender.

Result in Table 2 was also used to test significant relationship between motivation and slow learners' academic achievement in modular arithmetic in senior secondary school Mathematics as moderated by gender. The result revealed that z-value of .38 with associated probability value of .70 was obtained. Thus, the null hypothesis of no significant relationship was accepted since the p-value of .70 is greater than 0.05 level of significant. The researcher therefore, concludes that, no significant relationship exist between motivation and slow learners' academic achievement in modular arithmetic in senior secondary school Mathematics as moderated by gender.

DISCUSSION OF RESULTS

The results of this study revealed that, there exist a significant high positive relationship between motivation and slow learners' academic achievement in modular arithmetic in senior secondary school Mathematics. This implies that slow learners' academic achievement is associated with their motivation. This shows that when the slow learners are highly motivated, they will achieve higher. The results of the study are not surprising because, according to Haider, Qureshi, Pirzada and Shahzadi (2015), motivation is very important part of students' study life and plays a very important role in students' success.

The results of the study are in agreement with the findings of Gegbe, Sheriff and Turay (2015) which showed that motivation can be viewed as an internal state that arouses, direct and maintains behaviour. This means that motivation contributes to students' thinking in a given direction. The results of this study are also in consonance with the findings of Tokan and Imaculata (2019) who found that motivation has a direct effect on learning behaviour and that both directly affect learning achievement.

Secondly, the result of this study revealed that, gender moderated 4% of the variation in slow learners' academic achievement in modular arithmetic in favour of the males than their female counterparts. The 4% is very insignificant and therefore, no significant relationship exists between motivation and slow learners' academic achievement in modular arithmetic in senior secondary school Mathematics as moderated by gender. This implies that both male and female students can achieve equally in modular arithmetic when both genders are equally motivated.

The above contradicts the work of Carvalho (2016), who found that there exists a significant relationship between academic achievement and motivation as moderated by gender. The significant difference according to the study was in favour of the females. The difference in the findings may be attributed to certain factors that played roles in the learners' academic life which include the gender of the teacher in the sense that female students are easily moved to take their academic problems to female teacher than the male teacher and vice versa. It may be therefore that the initial researcher carried out the research with the population whose mathematics teachers are mainly females. The study also opposes Karatas and Erden (2014) work on academic motivation: gender, domain and grade differences. Their study found that motivation levels of female and male undergraduates were significantly different and this difference was in favour of male. In view of the above reason on the gender of teacher, the learners here may also be largely those whose mathematics teachers are males.

CONCLUSIONS

Based on the findings of this study, conclusion was drawn that there was a significant positive high relationship between motivation and slow learners' academic achievement in modular arithmetic in senior secondary school Mathematics. This shows that when the slow learners are highly motivated, they will achieve higher.

Gender moderated 4% of the variation in slow learners' academic achievement in modular arithmetic in favour of the males with respect to motivation. Further analysis revealed no significant relationship between academic motivation and slow learners' academic achievement in modular arithmetic in senior secondary school Mathematics as moderated by gender. This implies that both male and fequally motivated.

RECOMMENDATIONS/IMPLICATION OF THE STUDY

Based on the findings of the study, the following recommmemale students can achieve equally in modular arithmetic when the both genders are endations were made.

1. Classroom teachers should make it as a point of duty to motivate all students, most especially the slow learners during lessons for higher academic achievement in mathematics.
2. Parents along with the teachers must adopt some effective measures in all aspects of the lives of slow learners to sharpen and enrich the slow learners' brains.
3. Teachers should be rewarding the slow learners from time to time. If a slow learner can solve a mathematics problem no matter how easy, then they will be rewarded. Rewards like pen, pencil, mathematics games and free time to enjoy will be helpful.
4. Teachers should adopt the use of motivation in teaching their students for this will not only make them achieve higher but will help them to reduce the slowness in their students.
5. School counselor should be provided in all schools to help in identifying this group of students called slow learners and also help in solving other problems that students face during academic life.
6. Teachers/Facilitators should explain all topics in a way that every student can comprehend in order to achieve higher in all the subjects.

REFERENCES

1. Awodeyi, A. F. (2017). The Teaching of 'Modular Arithmetic' in Senior Secondary Mathematics Curriculum for Contribution to Sustainable Millennium Development Goals. International Journal of Mathematics and Statistics Studies 5(2), 8-13.
2. Ayebale, L., Habaasa, G. & Tweheyo, S. (2020). Factors affecting students' achievement in mathematics in secondary schools in developing countries: A rapid systematic review. Journal of the International Association for Official Statistics. 36(1), 73-76.
3. Bhat, A. (2019). Research design: Qualitative, quantitative and mixed method approaches.
4. Biswas, C (2015). The importance of Maths in everyday life. Times of India.S
5. Borderless, C. I. (2017). How Motivation Affects Academic Performance. Retrieved from https://medium.com/@TheCharity/how-motivation-affects-academic-performance-fcde79e8ef09

6. Breda,T., Jouini, E. & Napp, C. (2023). Gender differences in the intention to study math increase with math performance: https://doi.org/10.1038/s41467-023-39079-z

7. Carvalho, R.G.G. (2016). Gender differences in academic achievement: The mediating role of personality. Journal of Personality and Individual Differences, 94, 54-58

8. Dasaradhi, K., Rajeswari, C. S. & Badarinath, P.V.S. (2016). 30 Methods to improve learning capability in slow learners. International journal of English language, Literature and humanities (IJELLH). 4(2) 556-570.

9. Gegbe, B., Sheriff, A. & Turay, S. (2015). The Impact of Motivation on Pupils' Academic Achievement and Learning Outcomes in Mathematics among Secondary Schools in Sierra Leone: A Case Study Kori Chiefdom, Moyamba District Southern Sierra Leone. International Journal of Sciences: Basic and Applied Research(IJSBAR). 24(3), 27-38. Retrieved from http://gssrr.org/index.php?journal=JournalOfBasicAndApplied

10. Haider,S. A., Qureshi, M. M., Pirzada, S. S. & Shahzadi, I. (2015). A Study of Student's Motivation and its Relationship with their Academic Performance. Journal of Resources Development and Management. 8, 9-15. Retrieved from https:// www.iiste.org

11. Insall, M. & Weisstein, E.W. (2019). "Modular Arithmetic." Mathworl – A Wolfram Web Resource. Retrieved from http://wwwmathworld.wolfram.com/ModularArithmetic .html

12. Karatas H. & Erden M. (2014).Academic Motivation: Gender, Domain and Grade Differences Academic research paper on "Psychology". Retrieved from https://cyberleninka.org/article/n/1055689.

13. Lumenlearning.com (2019).Introduction to Motivation Retrieved fromhttps://courses. lumenlearning. com/boundless-psychology/chapter/introduction-to motivation/#:~:text=Psychologists%20 believe%20 that%20motivation%20is,physical%20pain%2C%20and%20maximize%20pleasure.&text=In%20realit y%2C%20our 20motivations%20are,mix%20can%20change%20over%20time.

14. Novitasari N., Lukito A. & Ekawati R. (2018). Slow Learner Errors Analysis in Solving Fractions Problems in Inclusive Junior High School Class. IOP Conf. Series: Journal of Physics: Conference Series 947(1), 012035. Retrieved from Doi: 10.1088/1742-6596/947/1/012035

15. Nwigboji, E.C. & Olo, E.E. (2017). Mathematics education as a tool for human development: Chalenges and prospects. ABACUS: The Journal of Mathematics Association of Nigeria, 42(2), 89-95.

16. Nworgu, B.G. (2015). Educational research: Basic issues and methodology. University trust publishers.

17. Odogwu et al (2015). Modular arithmetic. New concept mathematics for senior secondary Schools 1. Lagos, NG: Learn Africa.

18. 'Study and Exam'. (2018). Motivation. Retrieved fromhttps://www.studyandexam.com/motivation-meaning-types.html

19. Suranjana R.A., Ujjani, R. & Kanti, R. M. (2015). Peer Tutoring as a Remedial Measure for Slow Learners in a Medical School. Retrieved from https://www.researchgate.net/ publication/282920015 Peer Tutoring_as_a_Remedial_Measure_for_Slow_ Learners_in_a_Medical_School.

20. Tokan, M. K. & Imakulata, M. M. (2019). Correlation between motivation and learning behavior with learning achievement: A case study on the Biology Education Department Faculty of Teacher Training and Education University of Nusa Cendana. International Conference on Mathematics and Science Education (ICMScE). doi:10.1088/1742-6596/1157/4/042128

21. Vasudevan, A. (2017). Slow learners – Causes, problems and educational programmes. International Journal of Applied Research; 3(12): 308-313the-underachiever-and-the-slow-learner

22. Wahab, B. (2018). 12 courses you can study if you seriously hate Mathematics. Pulse TV. Retrieved from https://www.pulse.ng/communities/student/pulse-list-12-courses-you-can-study-if-you-seriously-hate-mathematics/e9xx411.

23. World Health Organization (WHO). (2019). Gender. Retrieved from https://www.who.int/ gender-equity-rights/understanding/gender-definition/en/

24. William, L.J. (2023). What is Mathematics? Tennessee Tech University publication.