

Relationship between Self-Efficacy and Student's Achievement in Mathematics among the Senior Secondary Two School Students in Bauchi Metropolis, Bauchi State.

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ABSTRACT

This study examined the relationship between mathematics self-efficacy and mathematics achievement among senior secondary school students in Bauchi Metropolis, Bauchi State, Nigeria. A correlational research design was employed. A sample of 400 Senior Secondary Two (SS2) students (180 males, 220 females) was selected using stratified random sampling from ten public secondary schools. Data were collected using a Mathematics Achievement Test (MAT) and a Mathematics Self-Efficacy Questionnaire (MSQ). Three research questions and three corresponding hypotheses were formulated and tested at a 0.05 significance level using Pearson Product Moment Correlation. The results revealed that both mathematics self-efficacy and achievement levels among students were low. A strong positive relationship was found between students' mathematics self-efficacy and their mathematics achievement ($r = 0.790$, $p < 0.001$). Gender-specific analyses showed a moderate positive relationship for male students ($r = 0.469$, $p < 0.001$) and a strong positive relationship for female students ($r = 0.688$, $p < 0.001$). The study concludes that improving students' mathematics self-efficacy is a viable pathway to enhancing their mathematics achievement. Recommendations include curriculum review, teacher training focused on self-efficacy development, and targeted interventions for male students.

Keywords: Mathematics self-efficacy, Students' achievement and Gender

Background to the Study

Mathematics is all encompassing and present in different form around us, the need for Mathematics is traceable to ancient period, this rose out of man's desire to count and keep record of things around him. Mathematics is a science of magnitude and number that is very useful virtually in all endeavors of life. Davies and Hersh, (2012) see Mathematics as the important subject not only from point of view of getting academic qualification at school or college but also as a subject that prepares the students for the future as well irrespective of which work of life they choose to be part of, this is because all fields of studies are dependent on it for problem solving and prediction of outcomes. Competency in Mathematics learning is vital to any individual and nation in domestic and business deals, scientific discoveries, technological breakthrough, problem-solving and decision making in different situations in life. Mafor (2014) summarized it all by saying that Mathematics relates to everything in the universe from the smallest to the largest. It is a tool that can be used in our daily life to overcome the difficulties faced. Ojimba, (2012) was of the view that without Mathematics there is no science, without science there is no Modern technology and without modern technology there is no modern society. The knowledge of Mathematics is an essential tool in our society. Therefore, Mathematics is a subject that education cannot function effectively without it.

A study conducted by (Belhu 2017) confirmed that Mathematics is the foundation for Science, Engineering and Technology studies. Mathematics skills and competence are critical determinants for post-school and career options available to the young generation (Kurniawan et al, 2020). In the West African standardized test, Mathematics has become the least performed subject for many years (Zalmon & Wonu 2017). To attain self-reliance and economic development maximum priority must be placed on Science and Mathematics. It may be in consideration of these and other vital usefulness of Mathematics that the Federal Government of Nigeria made it a core and compulsory subject at the primary and secondary levels of our system of education in Nigeria as contained in the National Policy on Education, FGN (2014). Mathematics holds a prominent place in the academic curriculum, and academic success in this subject is imperative in this age of rapid scientific and technological advancement.

The low academic achievement among students has led experts to come up with many variables that could effectively assist them to improve their achievement. Olanrewaju (2014) stated that different factors are capable of affecting the achievement of students, these factors may be student's intelligence, state of health, self-esteem, self-efficacy and anxiety. Others are student environment, availability of suitable learning environment, adequacy of educational infrastructure like text books and well-equipped laboratories. Self-efficacy could relatively be a factor that affect academic achievement; it is another factor that is likely to be considered as a variable defining and determining academic performance. Self- efficacy reflects confidence in the ability to exert control over one's own motivation, behavior and social environment (Behmanabadi & Baluchzade, 2013). Academic self-efficacy matches-up with academic achievement in mathematics examination as reported by Callaman and Itaas (2020), The insight that learners have about their academic capabilities aid to predict what they do with the knowledge and skill they possess which eventually determines their academic achievement. Mathematics anxiety commonly experienced by students when learning a new mathematical task or when performing mathematical task leads students to lack of interest in Mathematics. Students with mathematical anxiety possess little or no confidence in their ability to solve mathematical problems. Self-efficacy is an important concept in social cognitive theory according to (Bandura, 2012). Self- efficacy is defined as one's belief about one's capabilities to complete a specific task. The belief that individual holds about their abilities influence the amount of effort put into a task, willingness to complete the activities and the abilities to persist when facing difficulties. Mathematics self-efficacy is one's belief about how their own action and effort could lead to success in Mathematics (Luttenberger et al., 2018; OECD, 2013b). Self-efficacy in Mathematics is strongly influenced by attitude towards the subject. In other words, students who are often seen to feel 'helpless' when confronted by Mathematical situations probably have a mind -set of intimidation by Mathematics, while students with a positive attitude towards Mathematics see Mathematics as a friendly tool or a challenge. Students with low self-efficacy give-up easily when confronted with difficult Mathematics problems while the higher the level of self-efficacy, the higher the achievement as revealed by Allred (2013).

Self-efficacy in Mathematics indicates a student's self-belief in their ability to overcome difficulties or obstacles to solving Mathematics problems, such a belief is important to motivation because confidence that one will be able to solve a problem is a precursor to investing the time and effort needed to tackle it. Therefore, people have little or no incentive to act if they do not believe that they possess abilities to bring about desired results (Usher & Pajares, 2009) Within an academic context, self-efficacy is frequently described in terms of Academic Self-Efficacy (ASE), which defines learners judgments about one's ability to successfully attain educational goals (Elias & Mac Donald, 2007). A student's level of self-efficacy impacts the amount of effort applied and the degree to which he or she will persevere through a difficult task (Hibbs, 2013). People with higher self-efficacy and motivation do not easily give up when confronted with difficulties (Ersanla, 2015).

Self-efficacy has also been shown to determine the academic achievement at primary, secondary, and tertiary level. In addition, high levels of academic self-efficacy have been linked with good performance owing to increased motivation and persistence in tackling perceived difficult assignment. Thus, an increase in level of academic self-efficacy may lead to an increase in performance in Mathematics. Self-efficacy has generated research in different areas of studies most especially in education. It has been most prominent in the studies of educational construct such as academic achievement, attribution of success and failure, goal setting and problem solving. Most students believe that they do not have the ability to succeed in Mathematics and that has affected

their achievement in the subject. Apart from meeting the physical, emotional, social and psychological needs of an individual learner, the family or parent also influence the individual's cognitive perspective, that is, the views and beliefs that individuals have about themselves and their environment (Ashore & Brodzinsky, 2014). Strong self-efficacy is widely acknowledged as an essential ingredient in work-related achievement. Honicke and Broadbent (2016) examined 59 self-efficacy studies conducted at universities and discovered a modest relationship between academic achievement and self-efficacy indicating that students' academic achievement increases when they are taught to have stronger self-efficacy beliefs.

Statement of the Problem

Despite the recognized importance of mathematics in educational and national development, students' performance in the subject remains persistently low in Bauchi State. Reports from the Bauchi State Ministry of Education indicate that the proportion of students obtaining five credits including Mathematics and English in WASSCE between 2018 and 2023 remains below national expectations. This persistent underachievement raises concerns about the underlying factors influencing students' performance.

While several studies have examined cognitive and environmental determinants of achievement, less attention has been given to psychological constructs such as mathematics self-efficacy, particularly within the Bauchi context. Moreover, existing studies provide inconsistent evidence regarding gender differences in self-efficacy and achievement. Therefore, there is a need to empirically investigate the relationship between students' mathematics self-efficacy and their academic achievement, as well as examine whether this relationship varies across gender.

Students often express fear of the unknown and low self-judgment when they encounter Mathematics in the classroom and in real life situation due to the different views' students hold about their ability to perform well in any academic work that requires Mathematics. It appears that these views or beliefs affect their achievement in schools. Most students believe they lack the ability to succeed in school especially in Mathematics. They feel that Mathematics is meant for the gifted ones, the female also believe that Mathematics is sex biased and the males do well in it. The beliefs that students have about themselves and Mathematics have caused a lot of problems and set back to the educational system. Despite all importance attached to Mathematics by all stakeholders, senior secondary students still performed poorly in Mathematics at WASSCE level in Bauchi State of Nigeria. Report from Bauchi State Ministry Of Education shows that only 7%,19%,24%, 27%, 24.7% and 27% of Bauchi State students who sat for WASSEC were able to get five credit and above including Mathematics and English in the 2018-2023 consecutively. Also looking at the State by State students' Mathematics performance analysis research carried out by (Osuo-Siseken & Uche, 2020) in this analysis, Bauchi state came 32nd out of the 36 state when ranking students' performance by state while North-Eastern states consistently recorded low performance of students in year 2014-2018. It is dis-hearting to note that having seen a nationwide improvement in students WASSCE result, Bauchi State ranked 31st state in Nigeria for the 2019 WASSCE.

Numerous factors affect mathematics achievement, including intelligence, motivation, mathematics anxiety, self-efficacy, study habits, temperament, emotional trauma, and academic stress. However, only a few studies on self-efficacy have been reported in Nigeria, and virtually none have focused specifically on Bauchi State. Moreover, existing evidence on gender differences in self-efficacy and mathematics achievement remains inconsistent. This research gap motivated the present study, which empirically investigates the relationship between mathematics self-efficacy and mathematics achievement among senior secondary students in Bauchi metropolis.

There are many variables that affect students' achievement in Mathematics, some of these factors are psychological; Intelligence, Motivation, Mathematical Anxiety, Self-efficacy, learning habit, Temperament, Emotional trauma and Academic stress. There appear to be a research gap in the area of students' Mathematics Self-efficacy because only a few studies on this variable "Self-efficacy" have been reported in Nigeria. In Bauchi State of Nigeria not much has been done on relationship between Mathematics self-efficacy and Achievement in Mathematics, it is this gap that this research studies sought to fill.

Research Questions

The study seeks to find answers to the following research questions:

1. What is the relationship between senior secondary two students' Mathematics self-efficacy and their achievement in mathematics?
2. What is the relationship between senior secondary two boys mathematics self-efficacy and their achievement in mathematics?
3. What is the relationship between senior secondary two girls mathematics self-efficacy and their achievements in mathematics?

Hypotheses

The following null hypotheses will be tested at 0.05 level of significance.

1. H_{01} : There is no significant relationship between student's self-efficacy and their achievement in Mathematics.
2. H_{02} : There is no significant relationship between self-efficacy of boys and their achievement in Mathematics.
3. H_{03} : There is no significant relationship between self-efficacy of girl's and their achievement in Mathematics.

METHODOLOGY

This study is a survey that employs correlational research design method. The aim is to use a descriptive statistic to describe the level of students' Self-efficacy in Mathematics and their mathematics achievements, the correlation coefficient is computed to test the relationship between the Self-efficacy and students' achievement in Mathematics. The nature and strength of the relationship between these two variables will reveal whether or not Self-efficacy is a closely related to student achievement in Mathematics.

The target population were the 11,875 Senior Secondary (2) students in Bauchi metropolis. The Senior Secondary (2) students are selected to be the target because at this level they have form habits, attitude and mindset and interest towards each of the subjects they are offering and have a goal and aspiration for their future career. They have area of their strengths and weakness in school subjects. At SS1 the students may still be having a doubt of their areas of strength and weakness, likes and dislikes, believe about the subject while at SS2 it is believed they would have known where they belong in Mathematics and why it is so. At SS3 it may be too late to re-direct their belief, perception and interest about the subject. For the purpose of this study SS2 is targeted.

A sample is a little portion of the population that can perfectly represent the population. For the purpose of this study, 400 Senior secondary (2) students were selected to represent the entire senior secondary two students in the metropolis. It was made up of 180 male and 220 female senior secondary two students. Using Stratified random sampling, the researcher selected only 10 out of the government senior secondary school in the metropolis from different axis to cover the whole metropolis. The schools that were selected include mixed schools and the single sex schools, day schools and boarding schools in the metropolis. These schools selected are large enough and are schools where we have students from different background socio-economy and ethnic groups, in other to avoid gender biasness male and female students were selected. Also 40 students were selected from each of the 10 schools to form a total of 400 SS2 students from the metropolis.

The researcher used two sets of questionnaires to collect data from the students. First, a set of questions to test their achievement tagged Mathematics Achievement Test (MAT) which carried 20 Mathematics tasks for their level, these are objective questions gotten from New General Mathematics textbook for SS1. The second questionnaire is a Mathematics Self-Efficacy Questionnaire (MSQ) which also carried a set of 20 statements to test their Self-efficacy in Mathematics, to respond to a 5- Likert scale of measurement of self-efficacy to select

the level to which they agree with each statement. (SA)= Strongly Agreed, (A)= Agreed, (UN)= Uncertain (D)= Disagreed and (SD)= Strongly Disagreed.

Most of the test items for efficacy were adapted from the work of Benard Isiaho Omondi (2012) who worked on: The Impacts of Perceived Self-efficacy in Mathematics others were from the work of Han, Liou-Mark, Yu and Zeng (2015) and also the achievement test from the New General Mathematics.

To ensure that these items are valid and reliable it was presented to the Prof S.I Binda, the supervisor of this work and an expert in measurement and evaluation for proper guidance as an expert in the field of Mathematics education and measurement. The internal consistency reliability of the MAT was established using test-retest reliability method in order to ascertain a measure of stability of the instrument. The MSQ was estimated using the Cronbach Alpha through the aid of SPSS. Cronbach Alpha was used because of its value-ability for indicating scale reliability in the sense of the equivalence of items within single-construct scale. The reliability coefficient of 0.96 was estimated for the MAT scale, while that of MSQ was 0.94, which is reliable (Ugodulunwa, 2020). For the Mathematics Achievements Test, where we have 20 items(each for 5 marks) a score of 0-40 was considered low, 41-69 was considered moderate while 70 - 100 was considered a high achievement. Also on the Mathematics Self -efficacy Test with 20 items (each for 5 mark), a score of 0-40 for low self-efficacy, 41-69 for moderate self-efficacy and 70-100 for a high self-efficacy.

RESULTS

Research Question One

What is the relationship between student mathematics Self -Efficacy and their Achievements in mathematics?

Hypothesis One

There is no significant relationship between student's self-efficacy and their achievement in Mathematics.

Table 1 Relationship between Student's Self-efficacy and their Achievement in Mathematics

Variable	N	$\bar{x}$	SD	Df	R	P-value
Self-efficacy	400	39.20	15.71			
				398	.790	0.000
Achievement	400	39.43	12.73			

$P < 0.05$

Table 1 shows the result on relationship between student's self-efficacy and their achievement in Mathematics. The result showed $r(398) = 0.790$ $P < 0.05$, indicating a strong positive relationship between the two variables. Since the p-value of 0.000 is less than the 0.05 level of significance, the null hypothesis was rejected. An inference is drawn that at 0.05 level of significance there is a strong positive relationships between student mathematics Self -Efficacy and their Achievements in mathematics. High mathematics self -Efficacy implies high Achievement in mathematics.

Research Question Two

What is the relationship between boys mathematics self-efficacy and their achievement in mathematics?

Hypothesis two

There is no significant relationship between boys Self-Effica and their Achievements in mathematics.

Table 2 Relationship between self-efficacy of Boys and their achievement in mathematics

Variable	N	$\bar{x}$	SD	Df	R	P-value
Self-efficacy	180	33.20	7.87			
				178	.469	0.000
Achievement	180	37.09	12.59			

$P < 0.05$

Table 2 shows the result on relationship between self-efficacy of boys and their achievement in Mathematics. The result shows $r(178) = 0.469$ $P < 0.05$, indicating a moderately positive relationship between the two variables. Since the p-value of 0.000 is less than the 0.05 level of significance, the null hypothesis was rejected. It was concluded that there is a significant relationship between self-efficacy of boys and their achievement in Mathematics in Bauchi metropolis.

Research Question Three

What is the relationship between girls mathematics self-efficacy and their achievements in mathematics?

Hypothesis three

There is no significant relationship between girls mathematics self-efficacy and their Achievements in mathematics.

Relationship between Self-efficacy of Girls and their Achievement in Mathematics

VARIABLE	N	X	SD	DF	R	P-valu
sel-efficacy	220	44.11	18.59			
				218	.688	0.000
Achievements	220	41.35	12.55			
$P \rightarrow < 0.05$						

Table3 shows the result on relationship between self-efficacy of girls and their achievement in Mathematics. The result showed $r(178) = 0.688$ $P < 0.05$, indicating a strong positive relationship between the two variables. Since the p-value of 0.000 is less than the 0.05 level of significance, the null hypothesis was rejected. It was concluded that there is a significant relationship between self-efficacy of girls and their achievement in Mathematics in Bauchi metropolis.

Overall, students had low mathematics self-efficacy (68% below cut-off) and low achievement (mean 39.43%).

1. A strong positive correlation ($r = 0.790$) existed between self-efficacy and achievement.
2. Male students showed a moderate positive correlation ($r = 0.469$), while female students showed a strong positive correlation ($r = 0.688$).
3. Female students had higher mean self-efficacy (44.11) than male students (33.20), and also slightly higher mean achievement (41.35 vs. 37.09).

DISCUSSION

From summary of the data it shows that the levels of senior secondary two students' mathematics self-efficacy. From the table, 272 students representing 68% have low self-efficacy to mathematics, 80 of them representing 20% had high self-efficacy, while 48 students had moderate self-efficacy. It means that majority of the students

had low mathematics self-efficacy in senior secondary schools in Bauchi metropolis. This agrees with the findings Onoshakpokaiye (2020), that majority of the students had low mathematics self-efficacy in senior secondary schools, because of the teacher and how abstract the subject is.

Furthermore, Table 1 shows the result on relationship between student's self-efficacy and their achievement in Mathematics. The result showed $r(398) = 0.790$ $P < 0.05$, indicating a strong positive relationship between the two variables. Since the p-value of 0.000 is less than the 0.05 level of significance, the null hypothesis was rejected. This finding concurs with Sinan and Jongur (2016), they found that there was a strong positive correlation between academic self-efficacy of student in mathematics and the performance of students in mathematics among secondary school students.

Table 2 shows the result on relationship between self-efficacy of boys and their achievement in Mathematics. The result showed $r(178) = 0.469$ $P < 0.05$, indicating a moderately positive relationship between the two variables. Since the p-value of 0.000 is less than the 0.05 level of significance, the null hypothesis was rejected. It was concluded that there is a significant relationship between self-efficacy of boys and their achievement in Mathematics in Bauchi metropolis. This finding is in consonance with the findings of Najid A.M, Farsh M.B and Carla M. Ghanem (2021), that is positive relationship.

Table 3 shows the result on relationship between self-efficacy of girls and their achievement in Mathematics. The result showed $r(178) = 0.688$ $P < 0.05$, indicating a strong positive relationship between the two variables. Since the p-value of 0.000 is less than the 0.05 level of significance, the null hypothesis was rejected. It was concluded that there is a significant relationship between self-efficacy of girls and their achievement in Mathematics in Bauchi metropolis. This agrees with the findings of Hilliard and Liben (2010); Lane et al., (2012), female have a higher self-efficacy than male, this in turn improves their achievement in Physics.relationship between self-efficacy of boys and their achievement in Mathematics.

The summary of the data collected shows the relationship between students' self-efficacy and their achievement in mathematics in terms of gender. The result shows that the mean scores of male students' self-efficacy ($\bar{X} = 33.20$, $SD = 7.87$) is lower than that of achievement ($\bar{X} = 37.09$, $SD = .12.59$ with a correlation coefficient of 0.469. Indicating that, there is a very moderate positive relationship between male student's self-efficacy and their achievement in mathematics. . The result shows that the mean scores of girls' self-efficacy ($\bar{X} = 44.11$, $SD = 18.59$ is higher than that of achievement ($\bar{X} = 41.35$, $SD = .12.55$ with a correlation coefficient of 0.688. Indicating that, there is a very strong positive relationship between girls' self-efficacy and their achievement in mathematics. Gender differences in academic achievement have received a lot of attention over the past decades. Two seemingly opposite results have emerged from many of these studies. First, despite traditional stereotypes (Hilliard & Liben, 2010; Lane et al., 2012), there is strong empirical evidence that suggests that male students do not perform better than female students in math (Lindberg et al.2010)

CONCLUSION

This study demonstrates that mathematics self-efficacy is

strongly related to mathematics achievement among senior secondary students in Bauchi metropolis. Students with higher self-efficacy tend to achieve higher scores. Female students in this sample reported higher self-efficacy and achievement than their male counterparts, and the relationship was stronger for females. These findings underscore the importance of psychological factors in academic performance.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations were proffered:

1. With the result showing low achievement of students in Mathematics, there is a need to go back to the drawing board beginning with curriculum review, teaching strategies and understanding students' psychology towards the subject. Students' beliefs about their Mathematics abilities are very important component of motivation and of academic achievement.

2. Mathematics self-efficacy is developed most especially if there is positive teacher support and personal relevance. Hence, students' self-efficacy in Mathematics should be given attention in teaching the subject if one is serious in advancing the Achievement of the student. In particular, teacher educators should endeavor to infuse new and effective strategies like those that have been proven to provide positive results.
3. The ministry of education needs to devise ways of training teachers on developing student's self-efficacy so as to improve Achievement in Mathematics.

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