

Influence of Self-efficacy on Senior Secondary School Students' Academic Achievement in Mathematics in Kano State, Nigeria

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Abstract:

The study investigated the influence of self-efficacy on senior secondary school students academic achievement in Mathematics in Kano State, Nigeria. The study adopted Ex-post-facto research design. The sample of 398 Senior Secondary Three (SS III) students were drawn from the population of 77,393 using multi-stage sampling technique. Two instruments were used for collection of data. The first instrument was Self-Efficacy Inventory which was measured using the modified version of Betz and Hackett 1983 Self-efficacy Inventory (SI), while Mathematics Achievement Test was developed which consisted of 50 multiple-choice test items. The reliability of the instruments were established using Cronbach Alpha statistic and Kuder Richardson formular 21 (KR21). This yielded reliability indexes of 0.78 and 0.80 for the (MAT) and (SI) respectively. One-way ANOVA statistic was used to test the hypothesis formulated for the study at 0.05 level of significance. The study revealed a significant difference in the mean score of Students with high, moderate and low self-efficacy in Mathematics Achievement Test. In conclusion Students with high self-efficacy performed significantly better than those with moderate and low self-efficacy on Mathematics achievement Test. It was therefore recommended that, Mathematics teachers should incorporate psychological teaching approaches that will stimulate students' interest and make them develop confidence towards the subject

Keyword: High, Moderate and Low Self-efficacy and Mathematics Achievement Test

Article History: Submitted: 25th March, 2020,

Revised: 26th March, 2020,

Accepted: 27th March, 2020,

Published: 31st March, 2020.

I. INTRODUCTION

Mathematics has been described by Uzema (2016) as a dynamic and elegant field of human creation and a strong binding force among various branches of sciences, without which the knowledge of science would often remain superficial. It is a subject which deals with numbers and figures. Mathematics is used throughout our lives (National Mathematics Advisory Panel, 2008). The importance of mathematics in day-to-day activities is no longer news. However, what remains news is the fact that students' academic achievement in mathematics has not improved. According to Nigerian WAEC chief examiners report; specifically, between 2009 and 2018, the general mathematics achievement across Nigeria has been 29.98%, 31.05%, 35.2%, 30.7%, 41.1%, 48.9%, 49.9%, 38.4%, 47.5% and 44.7% Pass in mathematics will give you no admission, while not focus on credit passes (AI-C6) for 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017 and 2018 respectively, while the percentage of failures were 40.01%, 41.08%, 48.8%, 47.3%, 48.9%, 51.1%, 50.1%, 55.3%, 56.2% and 58.4% respectively. The statistical report showed that for the past five years the percentage of failure was higher than the percentage of pass and the most disturbing fact is that the percentage of failure increased drastically in 2018. Furthermore, a study was conducted by Abdul2015) which indicated that students' academic achievement in

Mathematics has not improved significantly in Kano State. By following this, the WAEC Chief Examiner's report (2018) observed that only 7.54 percent out of the total number of candidates in Kano state who sat for the examination in the year 2018 obtained a credit pass, 19.59 percent obtained pass while 72.87 percent of the candidates failed Mathematics. Numerous factors have been identified by some researchers for the poor academic achievement in mathematics by students', some of which include: shortage of qualified mathematics teachers, poor facilities, equipment and instructional materials for effective teaching (Adebule, 2012). Mathematics education in Kano State has persistently been experiencing one form of problem or the other, particularly in relation to the general poor academic achievement of secondary school students'. Adebule observed that, such academic problems include students' unparalleled hatred for the test, indifference, low self-efficacy and poor attitude towards mathematics, teachers' dissatisfaction, and poor learning environment, non-availability of appropriate textbooks and poor methods of teaching. Quite remarkably, most of secondary school students' in Kano State developed low level of self-efficacy in mathematics as a result of ineffective teaching methods and tools used by mathematics teachers (Adunola, 2015).

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Various research findings have shown that academic achievement in mathematics among senior secondary school students' in Nigeria and specifically Kano State was affected by psychological factors such as self-efficacy (Adesho, 2016). Self-efficacy as one of the areas of self-efficacy had been defined as one's judgment on his capabilities to organize and perform certain activities to achieve different types of academic achievement plans (Emmanuel, 2016). Academic self-efficacy leads to increased educational aspirations directly and indirectly. Students' with high/moderate self-efficacy are more diligent and participate in doing tasks more than students' who have doubt on their ability (Pintrich & Schunk, 2012). It is stated that students' who demonstrate greater senses of self-efficacy are more likely to put forth the necessary effort and persist longer when facing academic challenges (Schemafy, 2015). Schemafy further stated that students' who possess high efficacy about learning are more inclined to engage in self-regulatory processes like setting goals, using effective learning strategies, monitoring their comprehension and evaluating their goal progress. Various studies have demonstrated that students' who have high/moderate levels of academic self-efficacy beliefs have good feelings, behaviors, and positive thinking; can motivate themselves for actions and act accordingly; strive for academic achievement; persist longer when they encounter difficulties and until they get the solution; believe that failure is a temporal problem which they can manage; and attempt and use all possible ways to handle troubles and maintain their course of actions; are not frightened and challenged by difficult assignments and tasks rather they consider them as an opportunity for learning and mastery (Pajares, 2006).

Schwarzer (1992) confirmed that Individuals with high/moderate Self-Efficacy attempt challenging tasks more often, persist longer at them, and exert more effort. If there are failures, moderate efficacious individuals attribute it to a lack of effort or an adverse environment. When they succeed, they credit their achievement to their abilities. On the other hand, those that regard themselves as inefficacious shy away from difficult and challenging tasks, slacken their efforts and give up readily in the face of difficulties, dwell on their personal deficiencies, lower their aspirations, and suffer from low self-efficacy and stress. Conversely, individuals with moderate Self-Efficacy frequently persevere despite difficult tasks or challenging odds and often succeed because perseverance usually results in a successful outcome. Self-Efficacy has been found to positively relate to cognitive engagement and academic achievement (Pajares, 2006).

Students' with high self-efficacy have higher level of self-regulation skills compared to students with low self-efficacy. In contrast, students' who do not have high level of self-efficacy think that they have no cognitive skills necessary to deal with the issue. As a result, they do not consider it seriously. These students are often labeled as lazy, unresponsive, unmotivated, and depending on others (Bandura, 1997). Bandura holds the view that self-efficacy is enhanced and influenced by the outcomes of behaviors such as goal progress, academic achievement and input from the environment such as feedback from teachers and social comparison with peers. 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, it is very dangerous to neglect the importance of self-efficacy as it will produce an adverse effect on academic achievement in mathematics. (Adesemowo, 2005).

Yaman (2015) indicated that those with high Self-Efficacy perform better in Mathematics more often than those with lower Self-Efficacy. The author found that the relationship between self-efficacy and GPA was partially mediated by effort-regulation. Goulao, (2014) showed that students' level of Self-Efficacy is high (average=45) and a significant relationship exists between self-efficacy and academic achievement ($r=0.286$, at 0.05 level). Abesha (2012) results of SEM analysis indicated a significant and positive direct effect on self-efficacy and academic achievement. Lilian (2012) indicated that academic Self-Efficacy and Academic achievement are positively correlated, which is found to be consistent with most of the existing literature. Tewan (2013) found statistical difference between high, moderate and low self-efficacy in chemistry test among students. Also students' academic achievement and Self-Efficacy were positively correlated ($r=0.385$), which was also statistically significant at 0.01 with 98 degree of freedom (2-tailed). Further, a much related study was conducted by Onkundi (2014), the result shows significant difference between high and low self-efficacy in academic achievement. Variables and Gurhan (2016) found statistical significant differences between academic self-efficacy, and gender, grade level, economic situation of the family, and perceived academic achievement. Shkullaku (2013) explored differences in Self-Efficacy and academic achievement among Albanian students from two major universities in Tirana, Albania. The results of the study showed that there was a significant difference between high, moderate and low Self-Efficacy. Also, a significant relationship was found between the students' Self-Efficacy and academic achievement. Rahil, Elias, Loh, Muhamad, Nooreen and Maria (2006) showed that 51 percent of students had high self-efficacy while 48 percent showed low self-efficacy. Correlational analysis showed positive correlations between several dimensions of self-efficacy that is, academic achievement efficacy ($r=0.48$, $p=0.001$); other expectancy beliefs ($r=0.34$, $p=0.005$); and self-assertiveness ($r=0.41$, $p=0.005$) with academic achievement in English language.

Ali and Sepideh (2016) revealed an insignificant relationship subscales of academic self-efficacy and mathematics academic achievement of students' in at this level of education. Moturi (2012) found no significant difference between high, moderate and low self-efficacy in academic achievement.

Self-efficacy in mathematics indicates a student's self-belief in their ability to overcome difficulties or obstacles to apply mathematics in solving a particular problem. Such a belief is important to motivation because confidence that one will be able to solve a problem is a problem precursor to investing the time and effort needed to tackle it. Therefore, the influence of

self-efficacy on students' academic achievement in mathematics in senior secondary schools of Kano State cannot be wished away.

1.1 Purpose of the Study

The purpose of the study was to find out the influence of self-efficacy on senior secondary school students' academic achievement in Mathematics in Kano State, Nigeria. The Specific objective of the study is to examine:

1. the influence of self-efficacy levels (high, moderate and low) students on Mathematics achievement Test

1.2 Research Questions

The study addressed the following research question:

1. What are the mean scores of students with high, moderate and low self-efficacy in Mathematics Achievement Test?

1.3 Hypothesis

The null hypothesis was formulated and tested at 0.05 level of significance to guide the study.

H₀₁: There is no significant difference in the mean scores of students with high, moderate and low self-efficacy in Mathematics Achievement Test

II. METHODOLOGY

Ex- post facto survey research design was adopted for this study. Because ex-post-facto deal with cause and effect relationship and does not deal with manipulation of independent variables (Owonwami, Sakiyo & Filgona, 2017). However, the population of the study consisted of all Government senior secondary schools three (SSS III) students in Kano State, Nigeria. According to Kano State Senior Secondary Schools Management Board, Department of Planning Research and Statistics, as at June, 2017, the population of SSS III students was 77,393 in Kano State Nigeria, which spread in the 512 senior secondary schools in 14 educational zones across 44 local government areas in Kano State Nigeria (47,304 male and 30,089 female students).

The sample size of the study was 398 drawn from the population of 77,393 Secondary school students. The sample size for the study was obtained by applying Taro Yamane's (Yamane, 1973; Research Advisor, 2006) formula of finite population with a 95% confidence level. The formula of Yamane is presented thus: where n = signifies the sample size required, N = signifies the population under study, while e = indicates the margin of error (% at 0.05 level of significance). The research employed multi-stage sampling technique, because of different process in selecting Education zones, local government, schools and students within the population.

Two instruments were used for collection of data. The first instrument was Self-Efficacy Inventory which was constructed using the modified version of Betz and Hackett (1983) Self-efficacy Inventory (SI) by Athens and Georgia (2009), from where it was adapted to measure "belief ability regarding achievement in various mathematics-related tasks and behaviors". It is a self-report scale that measures self-efficacy inventory among the students. It was also used to identify the high, moderate and low self-efficacy levels of

students. The instrument consisted of 30 items. The scoring scale for the self-efficacy Inventory (SI) items was scored as follows: Never – was scored 1, Seldom – was scored 2, Sometimes – was scored 3, Often – was scored 4, Usually – This indicates high self-efficacy and was scored 5. Since each response in the (SI) was weighted 1 to 5, the minimum score was 30, while the maximum score was 150. The scores obtained in the (SI) helped to group the students' into three broad groups of high, moderate and low self-efficacy. The students' who scored 30-60 were grouped as low self-efficacy, 61-90 were grouped as moderate self-efficacy, while 91-150 were grouped as high self-efficacy.

The second instrument was Mathematics Achievement Test which consisted of 50 multiple-choice test items. Each question had 4 response options A-D. The items specification for Mathematics Achievement Test was based on Bloom's Taxonomy of cognitive level/Objectives. The topics were quadratic equations, Binary numbers, Law of Indices, Elementary statistics and Sequence. The justification for choosing these topics was that the students were exposed to the topics since SSS I and also serve as elementary topics for the beginner. Therefore, the duration set for students to attempt these questions was 1 hour. The item ordered Mathematics Achievement Tests were based on the six cognitive domains in the Bloom taxonomy of educational objectives namely: knowledge, comprehension, analyses, synthesis, and evaluation.

Construct validity was adopted for self-efficacy inventory (SI) while Face and content validity was employed for Mathematics Achievement Test which was subjected to validation, though the questions were already validated by the original examination bodies that is WAEC. The Cronbach alpha was used to analyze the items included in the self-efficacy inventory. A Cronbach alpha reliability coefficient index for the instrument was found to be 0.78. The researcher and five other research assistants personally administered the test to all the students in the sample schools selected for the study. Later on, the test script were collected for scoring and scored over 100. The descriptive statistics of mean and standard deviation was used to answer the research question, while one-way ANOVA statistic was used to test the null hypothesis at .05 level of significance.

III. RESULTS

Research Question: What are the mean scores of students with high, moderate and low self-efficacy in Mathematics Achievement Test?

The research question was answered using descriptive statistics of mean and standard deviation. The results are presented in Table 1.

Table 1: Summary of Descriptive Statistics of Mean Scores of Students with High, Moderate and Low Self-Efficacy in MPT

Anxiety Level	n	Mean	Std. Dev.
High	108	36.57	6.96
Moderate	111	34.55	9.15
Low	179	32.06	7.65

Table 1 shows the descriptive statistics of students with high, moderate and low levels self-efficacy in MAT. It shows that students with high self-efficacy had a mean score of 36.57 with a standard deviation of 6.96, students with moderate self-efficacy had a mean score of 32.06 with a standard deviation of 7.65, while students with low self-efficacy had a mean score of 32.06 with a standard deviation of 7.65. The result implies that Students with high self-efficacy had the highest mean score in MPT followed by students with moderate and low self-efficacy. In order to know whether these means were significant, it was further subjected to one-way ANOVA statistics as illustrated in Tables 2.

H₀₁: There is no significant difference in the mean scores of students with high, moderate and low self-efficacy in Mathematics Achievement Test

One-way ANOVA was used to determine if there is statistical significant difference in the mean score of students with high, moderate and low self-efficacy in Mathematics Achievement Test. The results are presented in Tables 2a and 2b respectively.

Table 2a: One-way ANOVA of Mean Score of Students with High, Moderate and Low Self-Efficacy in MAT

Source	Sum of Squares	Df	Mean Square	F	P-value	Decision
Between Groups	2712.402	2	1356.201	23.861	0.000	Significant
Within Groups	39616.135	395	56.838			
Total	42328.537	397				

*Significant

Table 2a shows one-way ANOVA of students with high, moderate and low self-efficacy in Mathematics Achievement Test. From the finding using two tailed test at the significant level of 0.05, the p-value is 0.000, degree of freedom is 395, and F-value is 23.861. The p-value of 0.000 is less than 0.05. Hence, the null hypothesis of there is no significant difference in the mean score of high, moderate and low self-efficacy students' on Mathematics Achievement Test was rejected and concluded that, there is significant difference in the mean score of high, moderate and low self-efficacy students' on Mathematics Achievement Test. Post Hoc tests was performed for the self-efficacy level. Turkey HSD Pairwise Comparisons of Self-efficacy Level on Mathematics Achievement Test was presented in Table 2b.

Table 2b: Turkey HSD Pairwise Comparisons of Students Self-Efficacy Level in Mathematics Achievement Test

(I) Self-efficacy Level	(J) Self-efficacy Level	Mean Difference (I-J)	Std. Error	P-value
High Self-efficacy	Low Self-efficacy	2.486 [*]	0.894	0.015
	Moderate Self-efficacy	-2.020 [*]	0.814	0.036
Low Self-efficacy	High Self-efficacy	-2.486 [*]	0.894	0.015
	Moderate Self-efficacy	-4.506 [*]	0.655	0.000
Moderate Self-efficacy	High Self-efficacy	2.020 [*]	0.814	0.036
	Low Self-efficacy	4.506 [*]	0.655	0.000

The results of the Turkey HSD Pairwise Comparisons of Self-efficacy Level in Mathematics Achievement Test shows at 0.05 level of significance that:

- High self-efficacy and Low self-efficacy students had a mean difference of (2.486*), which was significant at 0.05 as (P-value is 0.015), while High self-efficacy and

Moderate self-efficacy students had a mean difference of (-2.020*) which was significant at 0.05 as p-value is 0.036.

- Low self-efficacy and High self-efficacy students had a mean difference of (-2.486*), which was significant at 0.05 as (P-value is 0.015), while Low self-efficacy and Moderate self-efficacy students had a mean difference of (-4.506*) which was significant at 0.05 as p-value is 0.000.
- Moderate self-efficacy and High self-efficacy students had a mean difference of (2.020*) was significant at 0.05 as (P-value is 0.036), while Moderate self-efficacy and Low self-efficacy students had a mean difference of (4.506*) which was significant at 0.05 as p-value is 0.000.

This implies that students with high self-efficacy in Mathematics achieved remarkable results followed by students with moderate self-efficacy. Students with low self-efficacy, however, performed the least in MPT. This shows that the expression of both high and moderate self-efficacies enhanced students' achievement in Mathematics compared to low self-efficacy.

IV. DISCUSSION

In this study, the mean score of high, moderate and low self-efficacy on mathematic achievement in mathematic test were compared. The result reveals difference in the mean score of high, moderate and low self-efficacy students in mathematics achievement test. This implies that high self-efficacy students performed best followed by moderate and low self-efficacy students on Mathematics Achievement Test. Yaman (2015) supported that students with high Self-Efficacy perform better in Mathematics more often than those with lower Self-Efficacy. The finding is also in congruence with Onkundi, (2014); Goulao, (2014); Shkullaku, (2013) and Tewan (2013) the result shows significant difference between high, moderate and low self-efficacy in academic achievement. The finding agreed with Yaman, 2015; Abesha, (2012); Lilian, (2012) results which showed a significant and positive relationship between self-efficacy and academic achievement. However the finding was disagreed with Moturi (2012) who found no significant difference in the academic achievement of students high, moderate and low self-efficacy. Ali and Sepideh (2016) revealed a significant relationship between subscales of academic self-efficacy and mathematics academic achievement of students'. Adesemowo (2005) reported dangerous to neglect the importance of self-efficacy as it will produce an adverse effect on academic achievement in mathematics. Rahil, et al, (2006) showed that 51 percent of students' had high self-efficacy while 48 percent showed low self-efficacy.

V. CONCLUSION

The study concluded that students' self-efficacy towards Mathematics could influence achievement in the subject. In this study, students with high self-efficacy achieved remarkable results in Mathematics compared to their counterparts with moderate and low self-efficacies. Even though students with moderate self-efficacy had better results

in Mathematic compared to students with low self-efficacy, their achievement was insignificant when compared with that of students with high self-efficacy. Therefore, it could be seen that as students' self-efficacy in Mathematic drops from high to low, there was a corresponding drop in students' achievement in the subject. Thus it could be submitted that Mathematics teachers have a critical role to play in boosting students' confidence towards Mathematics.

VI. RECOMMENDATIONS

In view of the findings of this study, the following recommendations are made:

1. The teachers should encourage the Students to seek for counseling before and after examinations so as to increase their self-efficacy/confidence.
2. The teachers should help students to develop deeper interest in mathematics exercise of which they may participate for more improvement on high level of self-efficacy.

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