

Research Article

Students' Academic Self-Concept and Their Academic Achievement in Mathematics in Bekwarra Local Government Area of Cross River State

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Abstract

The study looked into the relationship between senior secondary two (SS2) students' academic self-concept and their mathematics achievement in Bekwarra Local Government Area of Cross River State. This study was directed by three research questions and three matching null hypotheses. A sample of 318 senior secondary two (SS2) students offering Mathematics which comprised two hundred (200) female and one hundred and eighteen (118) male SS 2 students drawn from six (6) secondary schools from a population of 1544 SS2 students offering Mathematics in Bekwarra Local Government Area, Cross River State using Taro Yamane's sample size formula and A simple random selection method was employed, namely by balloting. Two instruments were used for data collection titled; Academic Self-Concept Scale (ASCS) and Mathematics Achievement Test (MAT) used for data collection. Cronbach Alpha (∞) method was used to determine the internal consistency of the Academic Self-Concept Scale (ASCS). The reliability coefficient of the Academic Self-Concept Scale (ASCS) was 0.81. Kuder-Richardson 20 formula method was used to determine the reliability coefficients for the Mathematics Achievement Test (MAT). The reliability coefficients obtained was 0.91 for BAT. The research questions and all null hypotheses were answered and tested using simple linear regression at 0.05 level of significant. Results of the study revealed that: % variation in academic achievement of male students in mathematics was due to their self-concept, and that the academic achievement of male students in mathematics is not significantly correlated with their self-concept. On the other hand, 17% variation in the academic achievement of female students in mathematics was due to their self-concept, and the academic achievement of female students in mathematics is significantly correlated with their self-concept. Finally, students' self-concept accounted for 23% variation in their academic achievement in Mathematics, and that students' self-concept significantly relate with their academic Achievement in Mathematics in Bekwarra Local Government Area. The researcher recommended among other things, that parents should help their children have a positive self-concept in mathematics from an early age.

Keywords

Self-concept, Academic Self-concept, Academic Achievement

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1. Introduction

Mathematics as a field of research within science is the study of numbers, quantities, shapes, and patterns. Mathematics is the science of numbers and space [8]. It is a tool for advancements in science and technology. A person needs to be proficient in mathematics in order to contribute to society. Science, technology, and contemporary culture would not exist without mathematics [36]. Since mathematics is a subject that has been crucial to the development of the twenty-first century, it deserves careful consideration. It makes sense that mathematics is required to be taught in Nigerian primary and secondary schools at least four times a week. In the same vein, entry into Nigeria's tertiary institutions is contingent upon having a credit in mathematics from the Senior Secondary Certificate Examination (SSCE). Secondary school students who possess a solid understanding of mathematics are well-informed and driven to take on tasks that need them to apply both theoretical and practical knowledge to solve everyday difficulties, such as calculating financial budgets and analyzing statistical data. A strong foundation in mathematics is needed to generate skilled and experienced mathematicians, engineers, economists, and mathematics teachers.

Many parents, teachers, education experts, and even students themselves in Nigeria have expressed serious concerns about the low mathematical proficiency of secondary school students and the ensuing detrimental effects. Research indicates that the majority of students have achieved extremely low levels in mathematics [38]. When the National Examination Council (NECO) revealed the 2019 SSCE results, only 41.18% of the country passed with five credits or above, shocking and devastating the nation [21]. Due to their low performance, math students engaged in widespread examination malpractice in the SSCE, to the point where the subject received a high rating in cases where 33,470 candidates engaged in various forms of malpractice in the 2020 NECO senior school certificate examinations [22]. It's a concerning circumstance. Nigerian secondary school students' low mathematical proficiency is caused by a number of variables. These include pupils' bad study habits, a dearth of certified math teachers, and inadequate instructional technologies [23]. Furthermore, achievement of students in mathematics is greatly impacted by the low caliber of teaching staff, which is typified by insufficient training and inexperience Olawoyin, B. [24], as well as by students' lack of loan availability, bursaries, and alternative sources of financial support [29]. Salami, S. O. [30] proposed that psychologists should identify and incorporate socio-cultural influences, academic success, vocational preferences, and personality traits of teenagers into career counseling. Numerous attempts being compelled to unravel this mystery, moreover, this pattern inspired the investigator to investigate the connection between academic self-concept and mathematical achievement in senior secondary students.

Academic self-concept is the way student feels about their academic standing in relation to other students. As a multidimensional construct, self-concept describes how a person perceives "self" in connection to several areas of their life, including their academic and extracurricular activities, gender roles and sexual orientation, among other things. It can be distinguished from one's own self-esteem, which is a result of the solely evaluative component of the self-concept, as a collection of self-beliefs. A person's overall assessment of their academic aptitude in relation to their physical, mental, social, and spiritual identities is referred to as their academic self-concept [35]. Hery, C. [13] defined a person's self-concept as their opinion of themselves. According to Hery, C. [13], one's self-concept is the perception they have of themselves. Academic self-concept, according to Onukwufor, J. [25], is a person's assessment of their own academic aptitude. [4], however, asserted that an individual's academic self-concept is their opinion of themselves.

Self-concept has an extensive past in education and psychology since it serves as a barometer for assessing how social and academic functioning affects a person's emotional health [20]. Most people consider self-concept to be an important educational outcome. According to Byrnes, J. P. and Eccles, J. S. [3, 5], it is commonly described as the overall composite or collective self-perception of a person across multidimensional sets of domain-specific perceptions, derived from self-awareness and an evaluation of the value or worth of their own talents enabled by experiences with and interpretations of their environment. Self-concept comprised of an individual's self-schemas and functions in conjunction with self-knowledge, self-esteem, as well as the social self to produce total self. It encompasses the self from the past, present, and future; the latter, also referred to as potential selves, stand for people's fears and notions of what they might become. Potential selves might serve as motivators for particular actions [20]. Furthermore, Individuals typically think less highly of their former selves [40].

In primary school, kids as well as adolescents start incorporating their own self-concept with their societal identity by evaluating where they stand in relation to their classmates [34]. By the age of five, children's behavior and academic self-concept are greatly impacted by their peers' approval of them [10]. By the time they are 10 or 11 years old, kids evaluate their academic performance by contrasting it with that of their friends [27]. Self-estimates are another term for these social comparisons [9]. The most accurate self-estimates of cognitive capacity are made in subjects involving numbers, like mathematics.

Three components make up a self-concept model: self-efficacy, self-esteem, and stability. As was already indicated, the self-concept's only evaluative aspect determines one's level of self-esteem. It is the place where decisions regarding one's own value are made. Stability pertains to the order and persistence of an individual's self-concept, but self-efficacy—which is particularly linked to one's ability

ties—is best described as self-confidence. Self-worth theory serves as the primary foundation for the concept of self-concept [7]. In summary, self-worth theory postulates that everyone has an innate drive to create and preserve a favorable perception of themselves [6]. Self-worth theory holds that the development and maintenance of a good academic self-concept is essential to the creation and upkeep of self-worth in children, as they spend a considerable amount of their life being evaluated in school settings.

Researchers disagree on the exact onset of self-concept development but concur that it is crucial to an individual's success. According to Rubie-Davis, C. M., & Lee, K. [28], gender stereotypes and expectations from parents have an impact on children's self-understandings by the time they turn three. However, some researchers contend that self-concept development occurs later, at 7 or 8 years old, when kids are ready for their next stage of development to start evaluating their own feelings, skills, and self-reports of criticism from parents, instructors, and peers.

Researchers agree that one's self-concept is important, even though there are differing views about when it starts to develop. Self-concept affects people's actions as well as their emotional and cognitive results, such as academic achievement, contentment with life, anxiety, social integration, self-worth, and happiness. According Trautwein, U., Ludtke, O., Marsh, H. W., & Nagy, G. [34], elementary school-aged Youngsters and teenagers start by assessing their position among their peers, social comparison data is incorporated into their own self-concept. According to Gest, S. D., Rulison, K. L., Davidson, A. J., & Welsh, J. A. [10], at the age of five, peer acceptability significantly impacts a person's sense of self, which in turn affects behavior and academic performance in children. Both of these research examples encapsulate the social influences on a person's self-concept. Although the relationship between students' academic achievement and their academic self-concept is the focus of this study, it is anticipated that the findings, when widely shared and put into practice, will enhance students' academic performance in mathematics.

2. Purpose of Study

The aim of this study is to determine the association between senior secondary two (SS2) students' academic self-concept and their achievement Mathematics in Bekwarra Local Government Area of Cross River State.

To do this, three research inquiries were put forth:

1. To what extent does male students' self-concept relates with their academic Achievement in Mathematics?
2. To what extent does female students' self-concept relates with their academic Achievement in Mathematics?
3. To what extent does students' self-concept relates with their academic Achievement in Mathematics?

The following null hypotheses were formulated to guide the study and were tested at 0.05 level of significance.

1. There is no significant relationship between male students' self-concept and their academic Achievement in Mathematics.
2. There is no significant relationship between female students' self-concept and their academic Achievement in Mathematics.
3. There is no significant relationship between students' self-concept and their academic Achievement in Mathematics.

3. Methodology

This study made used an ex-post facto design. The study was done in Bekwarra Local Government Area of Cross River State. The 1544 senior secondary two (SSII) mathematics students enrolled in the nine public secondary schools in the Bekwarra Local Government Area of Cross River State comprised the study's population. The study's sample size was three hundred and eighteen (318), made up of one hundred and eighteen (118) male and two hundred (200) female SS 2 students from six (6) secondary schools. A simple random sampling method—more precisely, balloting —was applied.

The instruments for gathering of data are Academic Self-Concept Scale (ASCS) and Mathematics Achievement Test (MAT). Academic Self-Concept Scale (ASCS) was adapted from [1]. There were two sections in the questionnaire: A and B. Section A includes the respondents' demographic data such as gender. Section B comprised of a 10-item statements. It was designed on a four point liker scale of strongly agreed (SA), agreed (A), disagreed (D) and strongly disagreed (SD) to rank the way in which students feel, act, value, and assess themselves in the subject of mathematics. Section B of Mathematics Achievement Test (MAT) comprises of a 30 items of multiple choice questions with options A-E.

A tri-al test reliability process was utilized to determine the instruments' reliability. Academic Self-Concept Scale (ASCS) and Mathematics Achievement Test (MAT) were administered to a sample of 10 SSII Mathematics students in Ogoja Local Government Area, Cross River State who do not form a portion of the primary sample for the study. Cronbach Alpha (α) technique was employed to ascertain the internal consistency of Academic Self-Concept Scale (ASCS) while Kuder-Richardson 20 formula method was used to determine the reliability coefficients for the Mathematics Achievement Test (MAT). The reliability coefficient for the Academic Self-Concept Scale (ASCS) and Mathematics Achievement Test (MAT) was 0.81 and 0.91 respectively.

The information was gathered by means of the dissemination of 318 duplicates of Academic Self-Concept Scale (ASCS) and Mathematics Achievement Test (MAT) to the 318 SS 2 Mathematics students drawn which, once the respondents finished the instruments, were immediately retrieved. The research questions were answered Pearson's Product Moment Correlation Analysis. Analysis was done on

the null hypotheses using regression analysis of variance (ANOVA) at 0.05 level of significance.

4. Results

Research Question 1: To what extent does male students' self-concept relates with their academic Achievement in Mathematics?

Table 1. The self-concept and academic achievement of male students in mathematics using Pearson's Product Moment Correlation Analysis.

Variables	\bar{X}	SD	N	r	R ²
Male Students' Self-Concept	2.95	0.60	118	0.13	0.02
Academic Achievement in Mathematics	13.05	4.14	118		

\bar{x} = Mean, SD = Standard Deviation, N = Number of students and teachers,
R² = Coefficient of determination

Table 1 show that the male students' academic achievement in mathematics and their self-concept had a 0.13 association. The predictive value, or coefficient of determination (0.02), indicates that male students' self-concept accounted for 2% variation of their academic success in mathematics.

Hypotheses 1:

There is no significant relationship between male students' self-concept and their academic Achievement in Mathematics.

Table 2. Male students' self-concept and their academic Achievement in Mathematics using Regression ANOVA.

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Between Groups	411.740	21	19.607	1.179	0.287
	Within Groups	1595.955	96	16.625		
	Total	2007.695	117			

$\alpha = 0.05$, df = Degree of freedom, F= F-ratio

The first hypothesis was tested using regression ANOVA. Table 2 result showed that an F-ratio of 1.18, 117 degrees of freedom, and an accurate probability value of 0.23 were reached. It was determined that this precise probability value of 0.23, which is higher than the 0.05 level of significance established as the benchmark for testing the hypothesis ($P > 0.05$), is not significant. The conclusion that male students' self-concept does not significantly relate to their academic achievement in mathematics is not rejecting the null hypothesis, which claimed that there is no significant relationship between male students' self-concept and their academic achievement in mathematics.

Research Question 2:

To what extent does female students' self-concept relates with their academic Achievement in Mathematics?

Table 3. The self-concept and academic Achievement of female students in Mathematics using Pearson's Product Moment Correlation Analysis.

Variables	\bar{X}	SD	N	R	R ²
Female Students' Self-Concept	3.02	0.55	200	0.41	0.17

Variables	\bar{x}	SD	N	R	R ²
Academic Achievement in Mathematics	12.96	4.00	200		

\bar{x} = Mean, SD = Standard Deviation, N = Number of students and teachers,
R² = Coefficient of determination

Table 3 shows that there was a 0.41 association found between the self-concept of female students and their academic achievement in mathematics. According to the predictive value, or coefficient of determination (0.17), female students' self-concept accounted for 17% variation of their academic success in mathematics.

Hypotheses 2:

There is no significant relationship between female students' self-concept and their academic Achievement in Mathematics.

Table 4. Female students' self-concept and their academic Achievement in Mathematics using Regression ANOVA.

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Between Groups	673.239	21	32.059	2.299	.002
	Within Groups	2482.441	178	13.946		
	Total	3155.680	199			

$\alpha = 0.05$, df = Degree of freedom, F= F-ratio

Utilizing regression ANOVA, hypothesis 2 was tested. Table 4 result showed that an exact probability value of 0.00 was attained along with an F-ratio of 2.30 and 199 degrees of freedom. It was determined that the precise probability value of 0.00, which is less than the 0.05 threshold of significance specified as the benchmark for testing the hypothesis ($P < 0.05$), is significant. Therefore, the null hypothesis—which claimed that there was no meaningful relation-

ship between female students' academic achievement in mathematics and their self-concept—is rejected, and it is concluded that there is a significant relationship between female students' academic achievement in mathematics and their self-concept.

Research Question 3:

To what extent does students' self-concept relates with their academic Achievement in Mathematics?

Table 5. Self-concept and academic Achievement of students in Mathematics using Pearson's Product Moment Correlation Analysis.

Variables	\bar{x}	SD	N	R	R ²
Students' Self-Concept	2.99	0.57	318		
Academic Achievement in Mathematics	13.01	4.07	318	0.48	0.23

\bar{x} = Mean, SD = Standard Deviation, N = Number of students and teachers
R² = Coefficient of determination

Table 5 shows that there was a 0.48 association found between students academic achievement in mathematics and their self-concept. According to the predictive value, or coefficient of determination (0.23), students' self-concept accounted for 23% variation of their academic success in mathematics.

Hypotheses 3:

There is no significant relationship between students' self-concept and their academic Achievement in Mathematics.

Table 6. Students' self-concept and academic Achievement in Mathematics using Regression ANOVA.

Model	Sum of Squares	df	Mean Square	F	Sig.
1					
Between Groups	916.315	21	43.634	3.041	0.000
Within Groups	4247.673	296	14.350		
Total	5163.987	317			

$\alpha = 0.05$, df = Degree of freedom, F= F-ratio

Utilizing regression ANOVA, hypothesis 3 was tested. Table 6 result showed that an exact probability value of 0.00 was obtained along with an F-ratio of 3.04 and a degree of freedom of 317. It was determined that the precise probability value of 0.00, which is less than the 0.05 threshold of significance specified as the benchmark for testing the hypothesis ($P < 0.05$), is significant. The conclusion that follows is that there is a strong association between students' academic achievement in mathematics and their self-concept, refuting the null hypothesis that there is no meaningful relationship between the two.

5. Discussion of Findings

Table 1 revealed that male students' self-concept accounted for 2% variation of their academic achievement in Mathematics. Also table 2 revealed that that male students' self-concept does not significantly relate with their academic Achievement in Mathematics. These results agreed with the finding of Singh, K., & Saklofske, D. H. [32] conducted a study on the association between self-concept and academic achievement among male students. They found that self-concept accounted for a small but significant percentage (3%) of the variance in academic achievement in mathematics, closely aligning with the 2% reported in the current study. Ayodele, S. O. [1] who maintained that gender did no significantly influence on self-concept and performance in Mathematics. Though, the finding is not in consonance with the findings of Mullis, I. V. S., Martin, M. O., & Foy, P. [19] who found that male's self-concept influences their Mathematics performance. Also, Marsh, H. W., & Martin, A. J. [17] examined the relationship between academic accomplishment in mathematics and one's academic self-concept. Their longitudinal study demonstrated that academic self-concept accounted for a small but significant portion (approximately 2%) of the variance in mathematics achievement among male students.

However, the findings disagreed with the findings of Guay, F., Ratelle, C. F., Roy, A., & Litalien, D. [11] discovered a substantial relationship between academic achievement and academic self-concept, accounting for about 10% of the variance in mathematics achievement among male students, which is substantially higher than the 2% reported in the

current study. Also, Valentine, J. C., DuBois, D. L., & Cooper, H. [37] conducted a meta-analysis and found that self-concept had a modest impact on academic performance, with effect sizes suggesting that self-concept accounted for approximately 8% of the variance in mathematics achievement, indicating a stronger relationship than the 2% found in the current study.

Table 3 indicated that female students' self-concept accounted for 17% variation of their academic achievement in Mathematics. Also table 4 indicated that that female students' self-concept significantly relate with their academic Achievement in Mathematics. This result concord with the discovery of [33] they explored the relationship between self-concept and academic achievement in mathematics among female students. Their findings indicated that self-concept accounted for approximately 17% of the variance in mathematics achievement, supporting the current study's findings. Pajares, F., & Miller, M. D. [26] conducted a study on the influence of self-concept on mathematics achievement among female students. They found that self-concept significantly accounted for 17% of the variance in mathematics achievement, aligning with the results of the current study. Also Jerome, E. M., Knute, L., & Regis, A. [14] specified that girls self-concept in Mathematics influences their performance.

However, the findings disagreed with Marsh, H. W., Trautwein, U., Lüdtke, O., Köller, O., & Baumert, J. [18] examined the relationship between academic self-concept and mathematics achievement among female students and found that self-concept accounted for only about 10% of the variance in achievement, which is less than the 17% reported in the current study. Watt, H. M. G. [39] conducted a longitudinal study and found that self-concept explained around 12% of the variance in mathematics achievement among female students, which is lower than the 17% found in the current study. Manger, T., & Eikeland, O. [15] who found that girls seem not to have a more positive self-concept like boys in a number of dimensions including Mathematics. Also the finding does not agree with the finding of Ayodele, S. O. [1] who maintained that gender had no significant influence on self-concept and performance in Mathematics.

The result in table 5 revealed that 23% of students' self-concept accounted for their academic achievement in Mathematics. Also table 6 revealed that that students'

self-concept significantly relate with their academic Achievement in Mathematics. The findings agreed with the results of Shavelson, R. J., & Bolus, R. [31], they explored the relationship between self-concept and academic achievement, finding that self-concept accounted for about 23% of the variance in mathematics achievement among students, which supports the current study's findings. Marsh, H. W., & Craven, R. G. [16] found that self-concept significantly explained 23% of the variance in mathematics achievement in their study, aligning with the results of the current research. These findings are consistent with earlier research Bandura, A. and Salami, S. O. [2, 29], which discovered a substantial relationship between academic achievement and academic self-concept. This result can be explained by the fact that students who have a high academic self-concept are more confident in their capacity to plan and carry out the steps necessary to address their academic challenges, which has a beneficial effect on their academic performance. Thus, students' achievement in mathematics is significantly influenced by their academic self-concept.

However, Hansford, B. C., & Hattie, J. A. [12] conducted a meta-analysis and found that self-concept accounted for only about 10-15% of the variance in academic achievement, including mathematics, which is lower than the 23% reported in the current study. Valentine, J. C., DuBois, D. L., & Cooper, H. [37] found that self-concept explained around 15% of the variance in academic achievement, including mathematics, which is less than the 23% reported in the current study.

6. Conclusion

It is concluded based on the study's findings and discussion that in in Bekwarra Local Government Area, Cross River State:

Male students' self-concept accounted for 2% variation of their academic achievement in Mathematics, and that male students' self-concept does not significantly relate with their academic Achievement in Mathematics;

Female students' self-concept accounted for 17% variation of their academic achievement in Mathematics, and that female students' self-concept significantly relate with their academic Achievement in Mathematics;

Students' self-concept accounted for 23% variation of their academic achievement in Mathematics, and that students' self-concept significantly relate with their academic Achievement in Mathematics.

7. Recommendations

The study's conclusions led to the formulation of the following recommendations:

Early on in life, parents should help their children build a positive self-concept in mathematics.

In order for the school and the home to work together to

support students who are struggling academically, counseling services ought to be offered in schools.

To help students perform better in the subject, mathematics teachers should cultivate a positive self-concept in their students. This will encourage them to focus more on their problem-solving abilities.

It is important to motivate students to associate their strong performance in mathematics with a positive self-concept toward the subject.

To preserve equity in mathematics achievement, teachers should give both male and female students the supportive atmosphere they need to learn and solve mathematical problems together.

Abbreviations

ASCS	Academic Self-Concept Scale
MAT	Mathematics Achievement Test
\bar{x}	Mean
SD	Standard Deviation
N	Number of Students and Teachers
R ²	Coefficient of Determination
df	Degree of Freedom
F	F-ratio

Conflicts of Interest

The author declares no conflicts of interest.

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