

## **Association of self-concept and achievement in Mathematics: Evidence from a sub-Saharan student sample**

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### **ABSTRACT**

*This study was carried out to investigate Mathematics self-concept as a correlate of Basic 9 students' achievement in Mathematics in Gboko Metropolis, Benue State, Nigeria. Three research questions were asked and three hypotheses were formulated. The study adopted a correlation design. The population of the study was 3,682 while a sample of 400 Basic 9 students was drawn from ten secondary schools using multistage sampling procedure made up of 200 male and 200 female students. Two research instruments Maths Self-Concept Questionnaire (MSCQ) and Students Mathematics Achievement Test (SMAT) were adapted. The instruments were validated by three experts and trial-tested, on a population outside the study area. Cronbach Alpha reliability coefficient was used to get the reliability coefficient of MSCQ which was 0.78. While that of SMAT was 0.65 using Kuder-Richardson 21 formula. The research questions were answered using Pearson Product Moment Coefficients and hypotheses were tested at 0.05 level of significance using p-values of Pearson Product Moment Coefficient. The findings of the study revealed that there was a significant relationship between Mathematics self-concept and students' achievement in Mathematics. Furthermore, there was a significant relationship between Mathematics self-concept and students' achievement in Mathematics among male and female students. The study recommends that self-concept have the potential of improving students' achievement positively and should be encouraged among students.*

**KEYWORDS:** *Self-concept, Mathematics Achievement.*

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### **I. INTRODUCTION**

Over the years there has been a consistent record of poor achievement of secondary school students in Mathematics. This has lingered for long as it has remained an area of concern for researchers in the quest to explore the possible ways to minimize this challenge. And this is also very common for students from a sub-Saharan African community such as Nigeria. In an attempt to curb this challenge, researchers have tried to investigate several factors that could be responsible for the poor achievement of students in Mathematics. However, this challenge has continued to strive.

Mathematics over the years has remained one of the compulsory and most essential subjects across all levels of education, civilisations, cultures and socio-economic systems. In Nigeria, Mathematics is a compulsory subject for gaining admission into most tertiary institutions across the country regardless of the course of study. This is due partly to the fact that Mathematics is a model of thinking (Iji, 2008). Consequently, it encourages learners to observe, reflect and reason logically about a problem and in communicating ideas, making it the central intellectual discipline and a vital tool in Science, Commerce and Technology. Akinoso (2011) viewed Mathematics as the basis for Science and Technology and the tool for achieving scientific and technological development. The author further opined that it is one of the subjects that is most dreaded to learners among all subjects offered in schools. Students therefore tend to respond to it with less self-confidence, negative feeling and anxiety.

Despite the recognition accorded Mathematics and its relevance, Elekwa(2010) remarked that students exhibit a non-challant attitude towards Mathematics, even when they know that they need it to forge ahead in their studies and in life. Such students who have already conditioned their minds that Mathematics is a difficult subject may usually not be serious in the learning of Mathematics and therefore perform poorly in Mathematics tests and examinations. Such students may be poorly motivated majorly due to the conditioning of their

minds. Therefore, feasible ways of improving the performance has remained an area of great concern for researchers.

In understanding students' performance in Mathematics, researchers have undertaken cross sectional and longitudinal studies, drawing on several other educational, psychological, social and demographic concepts in order to investigate their relationships and effects with/on Mathematics performance as well as achievement. Some of these concepts have ranged from motivation, need for achievement, parenting style, socio-economic and other relevant demographics such as gender, age, level of parental income, locality, self-concept among others. The present study is seeking to further expand on existing findings and establish the validity of these findings among a sample of adolescents in Benue State. Therefore, the study will explore the link between Mathematics self-concept and interest as correlates of Basic 9 Students achievement in Mathematics in Gboko Metropolis of Benue State.

Self-concept has been defined by many people. According to Clark in Ajayi, Lawani and Adeyanju (2011) self-concept is considered to comprise various dimensions, areas or facets of academic and non-academic components. Academic self-concept is further divided into particular subject areas. (Mathematics self-concept, English self-concept and so on) while non-academic is divided into social, emotional, and physical self-concepts. Self-concept according to Hamachek in Ajayi, et al (2011), is the set of perceptions or reference points that the subject has about himself/herself, the set of characteristics, attributes, qualities and deficiencies, capacities and limits, values and relationships that the person knows to be descriptive of himself/herself, and what he/she perceives as data concerning his/her identity.

Studies have been carried out to determine the direction of the causal relationship between academic self-concept and academic achievement. Marsh, Trautwein, Ludtke, Koller and Baumert (2005), reported that improving students' academic achievement without enhancing their self-concept in the related academic domains is most likely to lead to only short term gains. This was supported by Liu (2009) that students who have less satisfying Mathematics performance may develop less positive Mathematics confidence, which in the end, may lead to lower Mathematics self-concept. On the other hand, students with less positive Mathematics self-concept are more likely to lack learning motivation, which may result in poor Mathematics performance. The author thus, concluded that Mathematics self-concept and academic achievement tend to affect and determine each other. This finding by Liu (2009) agrees with the suggestion by Marsh and Craven (2006) as it shows that prior Mathematics self-concept influences subsequent Mathematics achievement beyond the effects of prior academic achievement.

Guay, Ratelle, Roy and Litalien (2010) in a study found that students who perceived themselves as academically competent obtained higher grades because their academic self-concept led them to be more autonomously motivated at school. In contrast, students with negative perceptions about their academic capabilities, according to Bandura, Pastorelli, Babaranelli and Caprara as cited in Williams and Williams (2010), shy away from academic tasks because they view them as personal threats, have low aspirations and weak commitments to task-related goals and dwell on their personal deficiencies and adverse outcomes. Zimmerman and Martinez-Pans cited in Williams and Williams (2010) explained that once these beliefs are formed, they affect a student's performance in Mathematics through their influence on choice of activities, the amount of effort applied, the level of persistence, and the kinds of meta-cognition learning strategies invoked. Marsh in Scales, (2006) reported that the attainment of a positive academic self-concept affects academic behaviors, academic choices, educational aspirations and subsequent academic performance.

In recognition of the role played by academic self-concept in students' academic performance, research studies (Jaiswal & Choudhuri, 2017; Barman, 2018; Lee & Kung, 2018 etc) have been concerned with analyzing the type of relationship that exists between academic self-concept and academic achievement. Although the relationship between academic self-concept and academic achievement is well established in the literature, little research work has been done on the topic in Benue, especially at the Basic education level. This study, therefore, is intended to make a contribution towards filling this gap. A positive self-concept (the set of beliefs we hold about who we are) is a desirable outcome in many educational settings and is frequently posited as a mediating variable that facilitates other desired outcomes, such as academic achievement (Marsh in Lee & Kung, 2018).

Researchers have consistently reported a positive relationship between academic self-concept and academic achievement (Ross, Scott & Bruce, 2012; Sarouphim & Chartouny, 2017). Also, Ercikan in Lee and Kung (2018) indicated that students' Mathematics confidence was the strongest predictor of achievement, and students' attitudes toward Mathematics were the strongest predictors of participation in advanced Mathematics courses. Thus, more studies are needed to further investigate and clarify the mixed findings.

Therefore, it is also important to examine gender differences related to self-concept because self-concept may be significant for understanding achievement variation in gender in Mathematics education. Although research findings have highlighted the importance of self-concept in encouraging female to pursue and excel in Mathematics (Butt & Dogar, 2014; You, 2010). Self-concept is often overlooked in studies of gender

differences, which more often focus on gender differences in achievement (Lindberg, Hyde, Petersen, & Linn, 2010). However, gender differences in both Mathematics self-concept and content knowledge might play key roles in creating gender inequality in future Mathematics-related courses and career choices. Cvencek, Meltzoff and Greenwald (2011) opined that the increasing gender gap in Mathematics self-concept might later lead to actual gender differences in Mathematics achievement. Which agrees with Goldman and Penner (2014) who reported that one of the reasons women remain under-represented in the academic disciplines of Science, Technology, Engineering, and Mathematics (STEM) fields is a lack of Mathematics self-concept.

Existing research has found no significant gender differences in the global assessment of self-concept between male and female students (Rubie-Davies & Lee 2013). However, there has been significant gender differences in specific domains of self-concept, specifically in self-concept for Mathematical problem-solving, where males reported higher Mathematics self-concept than females (Kung & Lee, 2016; Good, Rattan & Dweck, 2012). Furthermore, Cvencek, Meltzoff and Greenwald, (2011) indicated that adolescent girls had a lower Mathematics self-concept than boys, consistent with gender stereotypes. Which agrees with the fact that boys favoured larger for self-beliefs than girls in beliefs of Math self-efficacy and fear of failure (Louis & Mistele, 2012; Ross, Scott & Bruce, 2012). In addition, Sullivan in Lee and Kung (2018) found that female students had lower Mathematics self-concept than male students.

By contrast, Nagy, Watt, Eccles, Trautwein, Lüdtke, and Baumert (2010) examined gender differences in Math self-concept and found that gender was not significantly related to self-concept. Hence, the Authors concluded that gender-related differences in Math self-concept should be questioned. Therefore, more studies are needed to examine and clarify these mixed findings and to determine whether boys' and girls' achievement actually differ relating to self-concept in Mathematics. To that end, this study seeks to investigate to what extent self-concept relates with male and female students Mathematics achievement in Junior Secondary School.

From the foregoing, it is clear that students are having challenges in Mathematics and several inputs have been made by different areas of research to curb this problem but much attention has not been given to Students Mathematics self-concept to see if the achievement of students will improve. It is against this background that this study seeks to investigate the relationship between self-concept and students Mathematics achievement in the Junior Secondary School.

Research Questions;

1. How does self-concept relate with Basic 9 students' achievement in Mathematics?
2. How does self-concept relate with Basic 9 male students' achievement in Mathematics?
3. How does self-concept relate with Basic 9 female students' achievement in Mathematics?

Statement of hypotheses;

1. There is no significant relationship between Basic 9 students' self-concept and achievement in Mathematics.
2. There is no significant relationship between Basic 9 male students' self-concept and their achievement in Mathematics.
3. There is no significant relationship between Basic 9 female students' self-concept and their achievement in Mathematics.

## II. METHODOLOGY

### *Research Design*

The study adopted a correlational design. This type of design seeks to establish the relationship that exists between two or more variables. Hence, it was employed because the researcher was seeking to establish the relationship between the one independent variable (self-concept) and one dependent variable (students' achievement).

### *Procedure*

The instruments were administered by the researcher alongside two research assistants. The respondents were adequately informed of the purpose of the research and the need to respond objectively. The Maths self-concept questionnaire was first administered, which lasted for 10 minutes.

After retrieving the first, the SMAT was then administered and retrieved after the expiration of 1 hour. The respondents' responses in the two instruments were scored and collated for analysis. The maximum score for SMAT was 40 and each correct item attracted 1 mark and incorrect option attracted zero (0), while the maximum rating scores for MSCQ was 4.

### *Instruments for Data Collection*

Two instruments were used for data collection. The first was a 20-item self-report questionnaire developed by Ayodele in (2011) titled, "Maths Self-concept Questionnaire" (MSCQ) was adapted, in which the students were asked to rate how they think, feel, act, value and evaluate themselves in Mathematics on a four-point scale,

namely: Strongly Agree=4, Agree=3, Disagree=2 and Strongly Disagree=1. The researcher adapted MSCQ to measure specific self-concept content in Mathematics as well as taking cognisance of the research topic and respondents involved in the study.

The second instrument was a 40-item multiple choice Students' Mathematics Achievement Test (SMAT) adapted from the Basic Education Certificate Examination (BECE) past questions. SMAT was adapted because the items on the BECE were too many and had cut across the entire upper Basic Mathematics curriculum which not all schools which the researcher sampled may have covered. The SMAT consisted of two sections, section A contains the information on the respondents that is class, time allowed and sex, while section B contains the questions. The total mark obtainable from SMAT is 40 marks. The reliability of the two instruments was found to be 0.78 and 0.65 respectively.

*Data Analysis*

The Pearson Product Moment Correlation Coefficient was used to answer the research questions, while the significant values of Pearson Product Moment Correlation Coefficient were used to test the hypotheses at 0.05 level of significance. A positive Correlation Coefficient implied a positive self-concept.

**III. RESULTS**

The section deals with the results according to the research questions and hypotheses. To ascertain the relationship between Mathematics self-concept and Basic 9 students achievement in Mathematics.

**Table 1: Correlation of Basic 9 Students Mathematics Self-concept and Achievement in Mathematics.**

Variable	Number of Students	Pearson Correlation (r)
Self-concept	400	.278
Achievement		

It was seen from table 1 that the correlation between students Mathematics self-concept and their achievement is 0.278, which indicated a weak positive relationship between Mathematics self-concept and students' achievement in Mathematics. This implied that as students' Mathematics self-concept increases their achievement in Mathematics also increases.

To find out relationship between Basic 9 students Mathematics self-concept and their achievement in Mathematics, the bivariate correlation has been used and tested at 0.05 level of significance.

$H_0$  : There is no significant relationship between Basic 9 students' self-concept and achievement in Mathematics.

**Table 2: Show the Correlation between Students Mathematics Self-concept and Students' Achievement in Mathematics.**

Variable	Number of Students	Pearson Correlation (r)	Sig.
Self-concept	400	.278	.000
Achievement			

In Table 2, the result shows that the sig-value of 0.000 is less than the alpha value of 0.05 level of significance. This shows that the test is significant. Therefore, the null hypothesis of no significant relationship is rejected. The result implies that there is a significant relationship between Mathematics self-concept and students' achievement in Mathematics.

To find out correlation between Basic 9 students Mathematics self-concept and their achievement in Mathematics among male and female, the bivariate correlation has been used and tested at 0.05 level of significance.

$H_0$  : There is no significant relationship between Basic 9 Male students' self-concept and achievement in Mathematics.

$H_0$  : There is no significant relationship between Basic 9 Female students' self-concept and achievement in Mathematics.

**Table 3: Show the Correlation of Basic 9 Male and Female Students' Mathematics Self-concept and their Achievement in Mathematics.**

Students	Number of Students	Pearson Correlation (r)	Sig.
Male	200	0.340	0.000
Female	200	.176	0.013

Male =  $P < 0.05$ , Female =  $P < 0.05$ .

It was seen in Table 3, that male students had a correlation coefficient of 0.340 while the female students had 0.176 which is an indication that both male and female students Mathematics self-concept has a positive relationship with Mathematics achievement. Although, that of the male students is stronger than the relationship among female students.

The result also shows that the sig-value of Male students is 0.000 which is less than the 0.05 level of significance and that of the female students is 0.013 which is less than 0.05 level of significance. This shows that the test is significant. The result implies that there is a significant relationship between the Mathematics self-concept of students and Mathematics achievement among male and female students. Therefore, the null hypothesis of no significant relationship is not accepted.

#### IV. DISCUSSIONS

The results show that the Pearson Product Moment Correlation Coefficient of students Mathematics self-concept and students achievement in Mathematics has a positive relationship. Eventhough the relationship was weak. The result also showed that there was a significant relationship between self-concept and achievement in Mathematics. The findings of this study agrees with the findings of Ross, *et.al* (2012), Sarouphim and Chartouny, (2017) who reported a positive relationship between academic self-concept and academic achievement. The result of this study is also in line with the findings of Dramanu and Balarabe (2013) and Ayodele (2011) that there is a positive relationship between self-concept and achievement. Likewise, the findings of Obilor (2011) revealed that Mathematics self-concept is significantly related to Mathematics achievement and that self-concept and Mathematics achievement of students are so strongly related that a change in self-concept could facilitates a change in achievement.

The result of this study showed that both male and female students Mathematics self-concept have a positive relationship with achievement in Mathematics. Although, the relationship of male students was stronger than that of the female students. The findings of this study also agrees with the findings of Lee and Kung, (2018) that boys had significantly higher Mathematics self-concept than girls. Likewise, this study agrees with the findings of Barman (2018) that there was a weak relationship between self-concept and achievement and that the impact of boys' self-concept is more than girls' self-concept on academic achievement.

#### V. RECOMMENDATIONS

The following recommendations are made based on the findings of this study.

1. State Ministries of Education through State Secondary School Education Boards is encouraged to promote the campaign of the need to improve the self-concept and interest of students by organising conferences, seminars and workshops for serving teachers to educate them on the place of self-concept and interest in the achievement of students in Mathematics in secondary schools.
2. Mathematics Teachers should pay deliberate attention in the classroom making sure they build and boost the self-concept of their students as well as develop their interest in learning Mathematics.
3. Curriculum Planners should include contents that promote self-concept and Mathematics interest in Mathematics curriculum.
4. Textbook authors should include contents that promote self-concept and Mathematics interest in Mathematics curriculum.
5. School Administrators should ensure Mathematics teachers present their lessons in such a manner that will encourage the self-concept of students and their interest in learning the subject.
6. Parents, should look for practical ways to encourage and develop a positive self-concept as well as interest among female students.

#### VI. CONCLUSION

Based on the findings of this study, it is concluded that self-concept of students has the potential to influence the Mathematics achievement of students. This implies that the poor achievement of students in Mathematics can be improved upon if Mathematics teachers do not only concentrate on teaching methods, instructional materials etc. as ways of improving students' achievement but take cognisance of the self-concept of their students in learning Mathematics as a factor that may improve the poor performance of students in Mathematics. And, that the Mathematics self-concept of students have the potential of influencing the

achievement of students in Mathematics with variations in gender. Therefore, the emphasis on the self-concept of students as it relates to their Mathematics achievement should be taken into cognisance.

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