Secondary School Students’ Academic Self-Confidence, Mental Toughness and Self-Esteem as Predictors of Academic Achievement in Mathematics Anambra State, Nigeria

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Abstract

Students’ academic self-confidence, mental toughness and self-esteem are non-cognitive constructs as well as indicators for effective learning. The study aimed to elucidate students’ academic self-confidence, mental toughness and self-esteem as predictors of academic achievement in mathematics in Anambra State. Four research questions and three null hypotheses guided the study. The study adopted a predictive correlational research design. The population of the study comprised of 21204 SS II students from which a sample of 791 were drawn. Multi-stage procedure was used to select the sample. Three standardized research instruments namely; Academic Self-Confidence Scale (ASCS), Mental Toughness Questionnaire (MTQ), and Self-esteem Questionnaire (SQ) were used for data collection. Students’ Mathematics Achievement Scores (SMAS) from the state wide promotion examination were used to represent mathematics achievement. Cronbach’s alpha was used to determine the reliability of the items in the instruments. Reliability index were found to be 0.81 for academic self-confidence, .68, for mental toughness, 0.83, for high self-esteem, and 0.76, for low self-esteem respectively. The data were analyzed using standard multiple regression analyses. The t-test for r, F-test and test of significance for β, were used to test hypotheses at .05 level of significance. Findings from the study showed that using academic self-confidence, mental toughness and self-esteem scores the seven assumptions tested in the study were fit and statistically significant to predict the regression model. Findings also indicated that academic self-confidence, mental toughness and self-esteem scores jointly predicted academic achievement in mathematics. Based on the above findings, it was recommended that students should invest more time in developing their academic self-confidence, mental toughness and self-esteem since the variables, uniquely and jointly predicted academic achievement.

Keywords: Academic Self-Confidence, Mental Toughness, Self-Esteem and Academic Achievement.

Introduction

The abysmal performance of the students in mathematics at the secondary school level in Nigeria has attracted the attention of educational planners, teachers and researchers to investigate the remote cause of this poor academic outcome. Based on this observation, researchers have shown tremendous concern towards this poor achievement in students' mathematics. Although, academic achievement has been defined as students cumulative scores in any academic context. These according to Mehrens and Lehmann (2008) are scores characterized the cognitive reports obtained from achievement test assigned to assess a person’s performance in a course of study which he/she has undergone. Even the researchers operationally defined academic achievement as teacher-assigned scores that represent the most salient performance feedback given to the students which serve as achievement indicator in a classroom test.

In an effort towards scientific and technological advancement, the importance of mathematics cannot be overemphasized. Nigeria needs nothing short of good achievement in mathematics at all levels of schooling. Unfortunately, the achievement of students in mathematics at the end of secondary education has not improved (Yaloye, 2013). In another study, Yusuf (2014) noted that achievement in mathematics is not only considered as important in its own right as a field of study and research, but also an essential guide to science and technological development in the society. Despite the relevance of mathematics and its achievement, reports from various schools and the information obtained from other standardized examination boards in Nigeria revealed that students still perform abysmally in the subject (Oguguo & Uboh, 2020). Many reasons have been given for dismay performance of students in mathematic context such as; students’ poor academic self-concept, low self-efficacy beliefs and high level of academic disengagement. Despite improvement on these identified variables, the problem still persists. One begins to think of some other variables that could influence, enhance and predict academic achievement in mathematics. Such variables are academic self-confidence, mental toughness and self-esteem.

It will be interesting to describe self-confidence as an individual’s personality construct that enables a person to have a positive or realistic view of his or herself in relation with the situation that he/she is into. The study of Miller, George and Steven (2015) described self-confidence as a person’s expectation of his/her ability to achieve a goal in a given situation and is a very influential factor in ensuring that a person’s potentiality to achieve is realized. In other words, persons with high level of self-confidence have realistic views of themselves and with capability which makes them remain persistence in their life endeavours. Nested to this present study is academic self-confidence that refers to the standard of ideas or the assurance that a person has in his/her own ability to achieve academically as it was assessed with the inclusivity of the academic self-confidence scale being developed by Jones (2001). Also, Koarraju and Nadler (2012) described academic self-confidence as student’s beliefs that they can perform well in school. It is a self-beliefs and construct that deals with individuals’ opinions and perspectives on how they feel about themselves in achieving academically. In another observation, Stankov, Morony and Lee (2014) noted that academic self-confidence could be describe as the individuals’ beliefs that they can accomplish a given task or achieve a desired academic objective. This indicates that academic self-confidence is one of the most influential indicator, facilitator, motivator and regulator of behaviour in peoples’ everyday academic life. For example, a growing body of historical evidence suggests that one’s perception of ability or academic self-confidence is the central mediating construct of achievement striving (Bandura, 1977). That is the self-resilience to stand strong and achieve in the complex academic task is fundamentally nested to the academic self-confidence of the students.

Considering its significant social role on students’ academic development, it is acceptable to say that academic self-confidence is not only an instigator by itself, but a judgment about capabilities of accomplishment of some academic goal. Therefore, must be considered within a broader conceptualization of motivation that assures positive academic concentration and resilience to achieve academic goal settings. This shows that academic self-confidence could be considered as a potent predictor of students’ academic achievement. As this has been conceived as students’ perceived ability and perceived competence that describes a person’s perceived capability to accomplish a certain level of
academic tasks (Koarraju and Nadler, 2012). For this reason, Bandura (1977) described academic self-confidence as people’s judgments of their capability to perform specific academic tasks.

Bandura’s observation also purported that academic self-confidence is a product of a complex process of self-persuasion that relies on cognitive processing of diverse sources of confidence information. That is the compilation of an individual’s positive fictional thought/fictional finalism that determines goal actualization. Based on these scholarly contributions, the researchers defined academic self-confidence as the students’ personality trait that enables them to have realistic view of themselves in the process of learning which contributes to academic achievement. That is, it is a person’s expectation of his/her ability to achieve the academic goal, as well as an influential factor which ensures that a person’s potential to achieve is realized. In other words, a person with a high academic self-confidence has a realistic view of his/her self and the capability that makes him persistence in the academic endeavor. In respect to the above observations, linking academic self-confidence with mental toughness and self-esteem has social imperative that would create more insight to understand that the three constructs could jointly predict students’ mathematics achievement. That is, the rate at which the self is being positively developed may have an impact on human mental capacity to remain focused and adaptable in any problem situation. The mental capacity to develop an insight in solving academic problem is one of the critical functions of mental toughness that determines students’ academic success.

Interestingly, Clough, Earle and Sewell (2002) opine that mental toughness is a personality trait that includes an array of positive characteristics such as perceiving challenge as an opportunity rather than a threat and feeling in control of life situations. Mental toughness (MT) reflects an effective coping mechanism in reaction to stressors and it facilitates proactively seeking out opportunities for personal growth (St Clar-Thompson, Bugler, Robinson, Clough, McGeown & Perry, 2015). Clough and colleagues, characterized MT in a composite of four sub-components (the 4Cs) such as; control, commitment, challenge and confidence. In the aspect of control (life and emotion), it represents the tendency to feel and act as if one is influential and keep anxieties in cheek. Commitment, described the tendency to be deeply involved in pursuing goals despite difficulties that arise. In the challenge aspect of mental toughness, it deals with the tendency to see potential threats as opportunities for self-development and continue to strive in changing environments. Then confidence on its own (inabilities and interpersonal) represents the belief that one is a truly worthwhile person in spite of setbacks and the ability to push oneself forward in social setting.

Previous research has shown that MT is an important construct for explaining individual differences in learning and educational performance (McGeown, St Clar-Thompson & Clough, 2016). Then, the predictive nature of this construct on students’ academic achievement in the mathematics domain has remained unclear in the educational research. On this note, the researchers operationally defined mental toughness as the psychological construct that involves having a personal stable self-beliefs that deal with seeking out challenge, willingness to achieve, persistence and resilience in a difficult situation with high level of commitment and self-control.

The implication is that mental toughness may serve as attention seeking behaviour which enhances self-beliefs. For example, in the aspect of self-esteem, individuals with low self-esteem may externalize blame for their problems and failures to protect themselves against feelings of inadequacy, inferiority and shame which described certain level of mental toughness as well as poor self-confidence in human being. Therefore, self-esteem from the study of Baumeister (1998) has been defined as the evaluative aspect of the self-concept that corresponds to an overall view of the self as worthy or unworthy. That is, a personal judgment of the worthiness being expressed in the attitudes the individual holds towards his/her self. Thus, self-esteem is an attitude about the self and is related to personal beliefs about skills, abilities, social relationships and future outcomes. This personality trait is produced over the life and can be either positive (high self-esteem) which resulted to positive outcomes or negative (low self-esteem) which resulted to negative outcomes (Saadat, Ghasezadch & Soleimani, 2012).

High self-esteem means that a person has a conviction to do what is right in life. Low self-esteem has been defined as a belief that represents individual’s negative emotion towards the self which embraces
negative appraisal by lowering his/her self-view (Ghazvini, 2011). The effects of self-esteem in students’ life is so crucial that those with high self-esteem are more likely to persist in the face of difficulties and are better equipped in their personal life’s to cope with challenges that arise unlike those with low self-esteem (Anyamene, Nwokolo & Ezeani, 2016). The high self-esteem individuals may be more likely to take steps to restore a damaged self-view than low self-esteem individuals. It shows that the persistence beliefs of an individual with high self-esteem could have a direct correlation with one’s self-confidence and mental toughness mostly in the challenging situations.

However, there are relatively little research evidences on whether self-esteem can relate with self-confidence and mental toughness to predict academic achievement. Though, Anyanwu, Ezenwosu and Emesi (2022) indicated that mental toughness negatively predicted academic achievement when compared with other variables. Also, that for every unit decrease in mental toughness, achievement decreased by – 0.194. The study of Anyanwu and Emesi (2020a) reported a very low positive and significant relationship between the two dimensions of self-esteem and academic achievement. In another study conducted by Anyanwu and Emesi (2020b), it reported that students’ self-esteem recorded a very low negative relationship with academic achievement in mathematics. Arshad, Zaidi and Mahmood (2015) also recorded that there was a significant relationship between self-esteem and academic performance. With the foregoing observations the present study aimed to examine the possibility of students’ self-confidence, mental toughness and self-esteem jointly predicting academic achievement. No known study has elucidated the relative link and the predictive nature of the three variables on students’ academic achievement. This is one of the gaps in the knowledge which the present study has sought to cover. Based on the paucity of study that jointly discussed the three independent variables that aimed the present study to explore secondary school students’ academic self-confidence, mental toughness and self-esteem as predictors of academic achievement in mathematics in Anambra State Nigeria.

Research Questions

The following null hypotheses will be tested at .05 level of significance.

1. To what extent are the assumptions of multiple regression equation for predicting students’ mathematics achievement scores using academic self-confidence, mental toughness and self-esteem scores met?

2. What is the nature of the regression equation for predicting students’ mathematics achievement scores using academic self-confidence, mental toughness and self-esteem scores?

3. What is the unique contributions self-confidence, mental toughness and self-esteem scores to predict students’ academic achievement scores in mathematics?

4. Which of the independent variables that best predicted students’ mathematics achievement scores?

Hypotheses

The following null hypotheses will be tested at .05 level of significance.

1. The regression equation does not significantly predict students’ mathematics achievement scores using academic self-confidence, mental toughness and self-esteem scores.

2. The unique contributions of academic self-confidence, mental toughness and self-esteem scores to predict students’ mathematics achievement scores is not significant.

3. Academic self-confidence, mental toughness and self-esteem scores do not significantly predict academic achievement scores in mathematics.
Research Method

The researchers adopted a predictive correlational design and used questionnaires to collect data for the study. The population of this study consisted of 21204 which represented all the senior secondary school students in Anambra State. A sample of 810SS2 students was drawn from the senior secondary schools in the six education zones in Anambra State. Multi-stage sampling procedure was used to select the respondents. The procedures for the selection were as follows: In stage one, three education zones were selected from the six education zones in the state by simple random sampling. Then in stage two, from each sampled education zone, one local government area (L.G.A) was selected through simple random sampling giving a total of three (3) L.G.As. In stage three, from each sampled L.G.A, 10 schools were randomly selected giving a total of 30 schools. Then, from each of the schools, 27 SSII students were selected for the study using a purposive sampling. This gave a total number of 810 students used in the study.

The study adapted three standardized research questionnaires namely, Tabachnick and Fidell (2001) Mental Toughness Questionnaire (MTQ), Eysenck and Eysenck Self-esteem Questionnaire (1976) and Jones (2001) Academic Self-confidence Scale (ASCS). The Students’ Achievement Scores in Mathematics (SASM) were obtained from the schools before the start of the administration of the other two instruments. This represents students’ achievement scores in mathematics from the state wide senior secondary one (SS1) promotion examination.

The methods used for validating the instruments were face and construct validity by the three experts from the Faculty of Education, Nnamdi Azikiwe University Awka. Cronbach’s alpha reliability method was used to determine the internal consistency of the items in the research questions such as 0.81, 0.68, 0.83 and 0.76 were obtained for academic self-confidence, mental toughness, high self-esteem, and low self-esteem respectively. The data were analyzed using standard multiple regression analyses. The t-test for r, F-test and test of significance for $\beta$, were used to test hypotheses at .05 level of significance.

Presentation of Results

The data were first screened for missing values, and 19 respondents had missing representing 2.3%. Hence likewise deletion approach was adopted. After deleting the 19 respondents, the sample size was reduced to 791. Thereafter, analysis of the study was carried out using standard multiple regression analysis with SPSS 26.

Research Question 1

To what extent are the assumptions of the regression equation for predicting students’ academic achievement in mathematics using academic self-confidence, mental toughness and self-esteem scores met?

Table 1. Correlation and Descriptive Statistics of Independent and Dependent Variables in the Regression Model for This Study (N = 791)

<table>
<thead>
<tr>
<th>Variables</th>
<th>AST</th>
<th>MT</th>
<th>HS</th>
<th>LS</th>
<th>Ach</th>
<th>X</th>
<th>SD</th>
<th>Var</th>
<th>Sk</th>
<th>Kw</th>
<th>Vi</th>
<th>Tf</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASF</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>19.81</td>
<td>2.776</td>
<td>7.704</td>
<td>-.246</td>
<td>-.568</td>
<td>1.002</td>
<td>.998</td>
</tr>
<tr>
<td>MT</td>
<td>.011</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>19.54</td>
<td>2.812</td>
<td>7.907</td>
<td>-.270</td>
<td>-.680</td>
<td>2.234</td>
<td>.448</td>
</tr>
<tr>
<td>HS</td>
<td>.019</td>
<td>.033</td>
<td>1</td>
<td></td>
<td></td>
<td>19.48</td>
<td>2.821</td>
<td>7.959</td>
<td>-.252</td>
<td>-.528</td>
<td>1.002</td>
<td>.998</td>
</tr>
<tr>
<td>LS</td>
<td>-.035</td>
<td>.743</td>
<td>.011</td>
<td>1</td>
<td></td>
<td>19.52</td>
<td>2.751</td>
<td>7.566</td>
<td>-.251</td>
<td>-.706</td>
<td>2.234</td>
<td>.448</td>
</tr>
<tr>
<td>Ach</td>
<td>-.003</td>
<td>.075</td>
<td>.050</td>
<td>.107</td>
<td>1</td>
<td>58.48</td>
<td>9.636</td>
<td>92.843</td>
<td>-.238</td>
<td>.022</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

Note: Std. Residual Min = -2.861, Std. residual Max = 3.669; Durbin Waston statistics = 1.972; Asf = Self-confidence, MT = Mental Toughness, HS = High Self-esteem, LS = Low Self-esteem and Academic Achievement.
Figure 1. The normal P-P Plot of Standardized Residuals Data Points of Academic Achievement

Figure 2. The Normal Distribution Curve of Standardized Residuals Data Points of Academic Achievement

Figure 3. The Scatter Plot of Standardized Residuals Data Points of Academic Achievement
To answer research question 1, seven assumptions of multiple linear regression were tested in this study. First, the assumptions of normality of the data were tested using Skewness and Kurtosis. The assumptions were ade since none of the Skewness and Kurtosis values of each of the variables do not exceed + 3 and – 3 as recommended. Second, the assumptions of absence of multivariate outliers was checked using standardized residual statistics and Cook’s distance statistics (1977). Result of standardized residual values indicated that the (Std, Residual Min = -2.861, Std, Residual Max = 3.669). It lies between -3 to 3 as recommended by (Tabachnick and Fidell, 2018). While the result of the Cook’s distance shows a maximum value of .023 which is less than 1 as recommended by (Cook, 1977). Hence, the assumptions of absence of multivariate outliers was not violated. Third, the assumptions of absence of multicollinearity among the predicting variables were checked using Variance Inflated Factor (VIF), and Tolerance Factor (TF). The Tolerance Factors and Variance Inflated Factors (Academic self-confidence, TF = .998, VIF = 1.002; Mental toughness, TF = .448, VIF = 2.234; High self-esteem, TF = .998, VIF = 1.002; Low self-esteem, TF = .448, VIF = 2.234; of the independent variables show that the values were less than 10 for Variance Inflated Factor and greater than .20 for Tolerance Factor respectively as recommended by (Schumaker, 2015). Hence, this assumption of absence of multicollinearity was made. Forth, the assumption of independent of error was tested using Durbin Waston statistics. The result shown a Durbin Waston statistics of 1.972 which is less than 3 but greater than 0 as recommended by (Denis, 2020). Hence, the assumption of independent of error was not violated. Fifth, the assumptions of normality of error distribution were tested using normal P.P plot of standardized residual. Figure 1 shows that the data met the assumption of normality of error distribution as the predicted values were distributed above zero in both dimensions and do not show any pattern. Sixth, the assumption of homogeneity of variance and linearity was tested using scatter plot of standardized predicted values. The result in figure 3 shows that the data met the assumption of homogeneity of variance and linearity as the predicted values were distributed above zero in both dimensions and do not show any pattern. Seventh, the assumptions of non-zero variance were tested using variance statistics and the data also met the assumptions of non-zero variances (Academic self-confidence, Variance = 7.704; Mental Toughness, Variance = 7.907; High Self-esteem, Variance = 7.959; Low Self-esteem, Variance = 7.566; Academic achievement, Variance = 92.843) as there is no zero variance for the variables in the study as shown in the table 1.

Research Question 2
What is the nature of the regression equation for predicting students’ mathematics achievement scores using academic self-confidence, mental toughness and self-esteem scores?

Table 2. Regression Coefficient for Academic Self-Confidence, Mental Toughness and Self-Esteem Scores (N = 791)

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Beta</th>
<th>Std. Error</th>
<th>Standardized Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>48.098</td>
<td>4.249</td>
<td></td>
</tr>
<tr>
<td>Academic Self-confidence</td>
<td>.000</td>
<td>.123</td>
<td>.000</td>
</tr>
<tr>
<td>Mental Toughness</td>
<td>-.040</td>
<td>.181</td>
<td>-.012</td>
</tr>
<tr>
<td>High Self-esteem</td>
<td>.168</td>
<td>.121</td>
<td>.049</td>
</tr>
<tr>
<td>Low Self-esteem</td>
<td>.402</td>
<td>.185</td>
<td>.115</td>
</tr>
</tbody>
</table>

Using the information in table 2, the nature of the regression equation for predicting students’ academic achievement in mathematics using academic self-confidence, mental toughness, and self-esteem scores follows:

\[ Y = b0 + b1x1 + b2 x 2 + b3 x3 + b4 x 4 \]
\[ Y = 48.098 + .000 x1 + -.040 x 2 + .168 x3 + .402 x4 \]
\[ Ach = 48.098 + 0 – 0.08 + 0.504 + 1.608 \]
Achievement = 48.098 + 0ASC – 0.08MT + 0.504HSE + 1.608LSE

ASC = Academic Self-Confidence, MT = Mental Toughness, HS= High Self-esteem, LS = Low Self- esteem. The equation shows that for every unit increase in academic self-confidence, achievement increased by 0. For every unit decrease in mental toughness, achievement decreased by -0.08. For every unit increase in high self-esteem, achievement increased by 0.504. For every unit increase in low self-esteem, achievement increased by 1.608.

Research Question 3
What is the unique contributions self-confidence, mental toughness and self-esteem scores to predict students’ academic achievement scores in mathematics?

Table 3. Regression Model Summary of Academic Self-Confidence, Mental Toughness and Self-Esteem Scores to Predict Students’ Academic Achievement Scores in Mathematics (N = 791)

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R-Square</th>
<th>Adjusted R-Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>.118*</td>
<td>.014</td>
<td>.009</td>
<td>9.593</td>
<td></td>
</tr>
</tbody>
</table>

To answer this research question, the adjusted multiple regression R square was used. The result of study shows that using academic self-confidence, mental toughness, and self-esteem scores yielded an adjusted R squared of .009. This implies that predictors accounted for about 0.9% of the variance scores in mathematics academic achievement.

Research Question 4
Which of the independent variables best predicted students’ academic achievement scores in mathematics?

Table 4. Regression Coefficient for Students’ Academic Achievement Scores in Mathematics Using Academic Self-confidence, Mental Toughness and Self-Esteem Scores (N = 791)

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Beta</th>
<th>Std. Error</th>
<th>Standardized Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>48.098</td>
<td>4.249</td>
<td></td>
</tr>
<tr>
<td>Academic Self-confidence</td>
<td>.000</td>
<td>.123</td>
<td>.000</td>
</tr>
<tr>
<td>Mental Toughness</td>
<td>-.040</td>
<td>.181</td>
<td>-.012</td>
</tr>
<tr>
<td>High Self-esteem</td>
<td>.168</td>
<td>.121</td>
<td>.049</td>
</tr>
<tr>
<td>Low Self-esteem</td>
<td>.402</td>
<td>.185</td>
<td>.115</td>
</tr>
</tbody>
</table>

To answer this research question 4, the standardized regression coefficient (B) in table 4 was used for comparison. The regression coefficients presented in table 4 shows unstandardized (B) and standardized regression coefficient (B) academic self-confidence scores are .000 and .000. For mental toughness scores are -.040 and -.012. For high self-esteem scores are .168 and .049. For low self-esteem scores are .402 and .115 respectively. Using the standardized beta for comparison, low self-esteem is mostly predicted students’ academic achievement in mathematics as shown by the B of .402. High self-esteem is the second most predicted students’ academic achievement in mathematics as shown by the B of .168. Mental toughness is the third most predicted students’ academic achievement in mathematics as shown by the B of -.040. While academic self-confidence is the least predicted students’ academic achievement in mathematics as shown by the B of .000.
Hypothesis 1
The regression model does not significantly predict academic achievement scores in mathematics.

Table 5. F-Test for Regression Model of Academic Self-Confidence, Mental Toughness, and Self-Esteem Scores on Students’ Academic Achievement in Mathematics Scores (N = 791)

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>Df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>1015.868</td>
<td>4</td>
<td>253.967</td>
<td>2.760</td>
<td>.027</td>
</tr>
<tr>
<td>Residual</td>
<td>72330.377</td>
<td>786</td>
<td>92.023</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>73346.245</td>
<td>790</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The analysis of variance in the table shows that the regression equation was significant (4, 786) = 2.760, p < .05. This implies that at least one of the independent variables significantly predicted the academic achievement in mathematics.

Hypothesis 2
The unique contributions of academic self-confidence, mental toughness and self-esteem scores to students’ mathematics achievement scores is not significant.

Table 6. T-Test of Regression Coefficient of Students’ Academic Achievement Scores in Mathematics Using Academic Self-Confidence, Mental Toughness and Self-Esteem Scores (N = 791)

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R-Square</th>
<th>Adjusted R-Square</th>
<th>Std. Error Estimate</th>
<th>t-cal for adj. R²</th>
<th>DF</th>
<th>t-crt.</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic</td>
<td>.118†</td>
<td>.014</td>
<td>.009</td>
<td>9.593</td>
<td>3.3828</td>
<td>789</td>
<td>1.960</td>
<td>S</td>
</tr>
<tr>
<td>Self-confidence</td>
<td>.000</td>
<td>.123</td>
<td>.000</td>
<td>.003</td>
<td>.998</td>
<td>NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mental toughness</td>
<td>-.040</td>
<td>.181</td>
<td>-.012</td>
<td>-.219</td>
<td>.827</td>
<td>NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High self-esteem</td>
<td>.168</td>
<td>.121</td>
<td>.049</td>
<td>1.391</td>
<td>.165</td>
<td>NS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low self-esteem</td>
<td>.402</td>
<td>.185</td>
<td>.115</td>
<td>2.168</td>
<td>.030</td>
<td>S</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To test hypothesis 2, t-test for adjusted R square was conducted. Results of the study shown in table 6 indicates that t-critical for adjusted R square is 1.960 while that of the t-calculated is 3.828 Since the t-calculated for adjusted R square 3.828 is greater than t-critical 1.960, the null hypothesis which states that academic self-confidence, mental toughness and self-esteem scores do not significantly predict achievement scores in mathematics is rejected and the alternative hypothesis is accepted. In other words, academic self-confidence, mental toughness and self-esteem scores significantly predict academic achievement scores in mathematics. Effect sizes were also evaluated using adjusted $R^2$ comparing it with Cohen’s $d$ statistics guideline, where $d < 0.20$ indicates a minimal effects size, $0.20 < d < 0.50$ indicates a small effect size, $0.50 < d < 0.80$ indicates a moderate effect size, and $d > 0.80$ indicates a large effect size. The value of $R$ adjusted square .009 indicates a small effect size.

Hypothesis 3
Academic self-confidence, mental toughness and self-esteem scores do not significantly predict academic achievement scores in mathematics.

Table 7. T-Test of Adjusted R-Square of the Regression Model for This Study (N = 791)

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Beta</th>
<th>Std. Error</th>
<th>Standardized B</th>
<th>T</th>
<th>P-value</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant Academic</td>
<td>48.098</td>
<td>4.249</td>
<td>.000</td>
<td>11.320</td>
<td>.000</td>
<td>S</td>
</tr>
<tr>
<td>Self-confidence</td>
<td>.000</td>
<td>.123</td>
<td>.000</td>
<td>.003</td>
<td>.998</td>
<td>NS</td>
</tr>
<tr>
<td>Mental toughness</td>
<td>-.040</td>
<td>.181</td>
<td>-.012</td>
<td>-.219</td>
<td>.827</td>
<td>NS</td>
</tr>
<tr>
<td>High self-esteem</td>
<td>.168</td>
<td>.121</td>
<td>.049</td>
<td>1.391</td>
<td>.165</td>
<td>NS</td>
</tr>
<tr>
<td>Low self-esteem</td>
<td>.402</td>
<td>.185</td>
<td>.115</td>
<td>2.168</td>
<td>.030</td>
<td>S</td>
</tr>
</tbody>
</table>
Table 7 shows that academic self-confidence, mental toughness and high self-esteem scores do not significantly predict academic achievement scores in mathematics since their p-values are greater than .05. While low self-esteem significantly predicted academic achievement in mathematics as the p-value is less than .05.

**Discussion of Findings**

The findings from the study indicated that the seven assumptions that were tested did not violate the rules that guide each as stipulated by the statistical guides being consulted in process of checking the assumptions. This is an indication that the academic self-confidence, mental toughness and self-esteem are potentially fit to examine students’ motivational propensity to respond and achieve academically. This supported the findings from the study of Anyanwu, Ezenwosu and Emesi (2022) which revealed that the seven assumptions that were tested in the study which involved mental toughness, self-worth and narcissism were statistically fit for their study. Meeting the assumptions of the regression model implies that the data are suitable and amenable to the analysis. It also implies that results obtained from the multiple regression analysis are more precise, accurate and reliable in predicting academic achievement in mathematics.

The findings from the result revealed that on the nature of regression equation, academic self-confidence, high self-esteem and low self-esteem contributed positively to the predicting model. While the mental toughness has negative contribution to the predicting model. This implies that academic self-confidence, mental toughness and self-esteem have certain level of influence on students’ academic achievement. The findings partially supported the study of Anyanwu et al (2022) which recorded that mental toughness negatively contributed in predicting the model.

In the present study, the result revealed that using multiple regression R square stands to prove a dynamic relationship among academic self-confidence, mental toughness and self-esteem as they jointly predict achievement scores in mathematics. The small percentage (0.9%) of these variables in predicting academic achievement scores indicated that the constructs are salient predictors of learning outcomes in mathematics. This supported the study of Anyanwu et al (2022) which revealed that mental toughness and other variables jointly predict academic achievement with the small percentage of (0.2%).

Findings from the study also indicate that the independent variables have roles to play on students’ academic achievement in mathematics. For example, when students’ level of academic self-confidence positively low, their level of willingness to adjust and engage in learning of mathematics will be positively low. Also, when students’ level of high self-esteem and low self-esteem are positively low, level of constructive worth and value attached in solving mathematics problems will be positively low. Then, when the level of mental toughness is negatively low, students’ readiness to learn mathematics at that time will be negatively low. This partially supported the study of Anyanwu et al (2022) which revealed that mental toughness negatively contributed in determining students’ academic achievement.

Finding in the study using effect sizes to evaluate using adjusted R² to compare it with Cohen’s d statistics guideline, the value of R adjusted square .009 indicates a minimal effect. This shows that academic achievement is decreasing considering the motivational constructs being tested in the present study. It is an indication that there is students’ motivational apathy to approach, adjust and engage in the learning task as well as to achieving academically in mathematics. This supported the finding from the study of Anyanwu et al (2022) which revealed that the value of R adjusted square .002 as it indicates a minimal effect.

**Conclusion**

The outcome of the present study unveiled that the students’ academic self-confidence mental toughness, and self-esteem jointly and statistically predicted their academic achievement in mathematics. This implies
that the independent variables uniquely and significantly predicted students’ academic achievement scores in mathematics.

**Recommendations**

Based on the findings, the following recommendations were made:

1. **Students** should invest more time in developing their academic self-confidence, mental toughness and self-esteem since the variables, uniquely and jointly predicted academic achievement.

2. **Teachers** should use verbal persuasion to motivate students to adapt academic self-confidence, mental toughness and self-esteem as academic learning behaviours that could have positive influence on their learning beliefs system that direct the desire to learn.

3. Based on the significant result that was recorded in the study, educational psychologists should introduce some positive cognitive-behavioural strategies to be used by teachers and parents in training their children’s cognitive and behavioural beliefs to engage in the learning task mostly in the subjects that required constructive and critical reasoning like mathematics.

4. Future researchers in the field of educational psychology should adopt other research designs such as comparative correlation design and hierarchical predictive research design to revisit these variables either within the same academic context or other context such as higher institution perspective.

**References**


