



Academic Engagement as a predictor of Mathematics Achievement Among Senior Secondary School Students in Ogun State.

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Abstract

This study investigated student academic engagement as predictors of male and female Mathematics achievement in senior secondary school. A correlation research design of ex-post facto type was used. Sample used comprised 1680 (SS2) students offering from the twenty one randomly selected schools in the three local government areas of Ogun State's Remo division, Nigeria. The instruments are validated and give Mathematics Student Academic Engagement Scale (MSAES) with $r = 0.776$ and Mathematics Achievement Test (MAT) with $r = 0.88$. Two hypotheses were formulated and analyzed using multiple regression analysis. Results revealed no significant contribution of the predictor variables in male students' achievement in Mathematics. Meanwhile the study revealed that the predictor variables significantly contribute to the variance in female students' achievement in Mathematics. This study concluded that Mathematics achievement is well predicted by student's academic engagement. Hence it is recommended that stakeholders in Nigeria secondary schools should ensure that the students are academically engaged.

Keywords: Academic Engagement, Achievement, Behavioural, Cognitive, Emotional, Gender, Mathematics

Introduction

Learning is a process through which an individual acquires knowledge, skills, and attitudes essential for productive societal participation. According to National Policy on Education of the Federal Republic of Nigeria (2014), education amplifies an individual's innate abilities and talents, benefitting both the person and the broader community. Education is understood in terms of knowledge acquisition, subject matter, and the learning process itself, as described by Okeke (2007). The knowledge, skills and process senses can only be acquired in school through the acquisition of Mathematics.

According to Asanre *et al.*, (2021), the influence of mathematics extends across a wide spectrum of human pursuits, encompassing fields like politics, economics, science, and technology. It acts as a foundational framework for comprehending and applying scientific concepts, underscoring its pivotal importance. Mathematics, often regarded as the science of quantity and number, holds immense utility across virtually every academic discipline (Schenkel, 2020).

Mathematics has often been perceived as a subject exclusive to science students. However, in today's era of advanced digitalization, science, and technology, its relevance has expanded far beyond just academia. Mathematics is now an integral part of everyday life and is vital in various spheres,

emphasizing that it's not just for students but for everyone, (Asanre *et al.* 2023).

As highlighted by Asanre *et al.*, (2021), the far-reaching impact of mathematics is evident in various domains of human activity, including politics, economics, science, and technology. It functions as the fundamental framework for comprehending and applying scientific concepts, serving as a cornerstone of understanding. However, as noted by Ifamuyiwa *et al.*, (2018), despite the universal, disciplinary, social, cultural, and practical significance of mathematics, it remains a formidable challenge for learners across all educational levels. They contend that students often struggle with mathematics due to its inherent complexity, the level of engagement required, teaching methodologies, communication barriers, and the failure of educators to connect mathematical concepts to the students' immediate environment. These factors collectively hinder the consolidation, application, and transfer of mathematical knowledge.

According to Abiodun *et al.*, (2022), the Chief Examiners' Reports for the West African School Certificates exams have raised concerns about the performance of learners in mathematics. These reports highlight substantial weaknesses in the scores achieved by students, indicating a noteworthy challenge. As stated by Asanre (2023), academic achievement is characterized by students' successful acquisition of the

academic content provided by their school. Also, to enable the instructors assess whether students have truly grasped this academic material and often find it necessary to go beyond a mere abstract evaluation of students' knowledge.

Academic achievement is typically evaluated through exams or continuous assessments. However, there's no consensus on the best evaluation method or which type of knowledge is more crucial: procedural (skills) or declarative (facts), (Asanre *et al.*, 2023). Amanda Szabo-Reed (2018) posited that schools with their students demonstrating higher academic performance tend to receive greater funding compared to those with lower achievements. Furthermore, a perception has emerged, largely based on Gappi's (2013) findings, suggesting that males typically achieve higher in Mathematics than females. As a result, a misconception has developed among some, wrongly associating mathematical prowess predominantly with the male gender.

The emphasis on gender is essential when undergoing school-related matters, given that the nuances in Mathematics teaching, learning, and achievement are often explained through various perspectives rooted in gender differences, (Rahmon *et al.*, 2021). Gherasim *et al.*, (2013) examined gender effects on Mathematics achievement among students, the data suggests that female students outperformed male students in mathematics. High achievement in Mathematics is seemed to be associated more with males than females. This has led many people to believe that Mathematics is male domain (Asanre, *et al.*, 2023). Also, Lindberg *et al.*, (2010) determined that there is very little of a gender difference in Mathematics.

Student' poor Mathematics achievement can be traced to the drop in student academic engagement, (Hobson, 2015). Also learning environment must be one where students are more engaged in order to help them study Mathematics to their full capacity. Students who do not believe they can achieve perhaps lack the drive to participate in their classes (Rocca, 2010). More so, it is observed in our secondary schools today, students are not learning in classes, harder to motivate, more difficult to hold their attention and only a few of these students are interested in what goes on in the class.

This is corroborated by Al-mutawah *et al.*, (2017) reported that there is a shortcoming trend in the development of academic engagement and student learning outcomes in Nigerian senior high schools. Hence, this lack in involvement has been an ongoing issue that might be detrimental to the future health of

Nigeria's educational system. Gibbs and Poskitt (2010) opined that the sense of community pupils feel connectivity, professors, classmate, as well as their self-efficacy, sense of agency, and commitment to succeeding in their academic settings are all parts of the multifaceted concept of engagement.

Academic engagement refers to the depth and breadth of students' emotional, cognitive, psychological, and behavioral responses to both the learning process and their academic and social activities, both inside and outside the classroom, (Gunuc & Kuzu, 2014). Imaobong and Mfonobong (2013) opined that, academic engagement is a crucial component of learning because it boosts performance, supports high academic aspirations and is a reliable indicator of students' long term academic success. According to Selim (2014) opined that academic engagement in students refers to their readiness, needs, wants, drive and achievement in the learning process. Hadayah *et al.*, (2020) reported that students' academic engagement is not only the number of times students respond but the quality of their responses on the degree and caliber of their involvement during the instructional procedure.

In a research carried out by Wei *et al.*, (2020), they proposed that student academic engagement encompasses a multifaceted and interrelated set of attributes. These attributes encompass a wide range of factors, including behavioural, cognitive and emotional components. Behavioural engagement is therefore a continuum of growing participation (i.e., adherence to school and classroom policies, assuming a leadership role in the classroom, engaging in school government and participating in extracurricular activities), Asanre (2023). Emotional involvement is seen as an affective orientation toward both learning itself and school-related objects like peers, instructors, and school (Wei *et al.*, 2020).

Researchers defined cognitive engagement as students' investment as they learn on their own and based on their requirements and how they respond to mental problems (Gunuc & Kuzu, 2014). The three facets of engagement have been regarded as essential because low levels of engagement in any environment can result in disruptive classroom behaviour (behavioural), student despising Mathematics (emotional), or children not learning (cognitive), according to Boaler (2009).

As noted by Gunuc and Kuzu (2014), that it was crucial to analyze the cognitive, affective, and behavioural components collectively because they were

seldom addressed jointly in research. Behavioural and emotional engagement can be driven by cognitive engagement as well. As a result, for a research to be suitable, all three dimensions must be taken into account. It is on this background that this study looks at behavioural, emotional and cognitive engagement as predictors of both male and female mathematics achievement in senior secondary schools in Ogun State's Remo division.

Objectives of the Study

The objective of this study is to ascertain the extent to which the aspects of students' academic engagement (behavioural, emotional and cognitive) predict male and female Mathematics achievement in senior secondary school.

Hypotheses

The following hypotheses were formulated and tested at 0.05 level of significance.

- H₀₁:** Cognitive, behavioural and emotional engagements, when taken collectively, will not significantly predict male Senior Secondary Students' Mathematics achievement in schools.
- H₀₂:** Cognitive, behavioural and emotional engagements, when taken collectively, will not significantly predict female Senior Secondary Students' Mathematics achievement in schools.

Methods

This study employed a correlational research design to examine the predictive power of the predictor variable on the criterion variables. This is because the researcher examined the ability of predictor variable (academic engagement) to predict criterion variable (academic achievement) without manipulation and intervening or making experimental changes. The population in this research include all public co-educational Senior Secondary School Mathematics students Two (SS2) in Ogun East Senatorial District of Ogun State which comprises one hundred and twenty seven (127) schools out of which forty-one (41) is from Remo division while eighty-six (86) is from Ijebu division. Multi-stage sampling technique was used to select public Senior Secondary School students offering Mathematics in the Senatorial District of Ogun State. At the initial stage, the Senatorial district were stratified based on the existing number of the division of senatorial districts in the state; one (1) out of the two divisions (Remo and Ijebu division) was selected purposively based on the fact that there is scarcity of study on Student academic engagement aspects as indicators of learning outcomes in Senior Secondary

School Mathematics, therefore, Remo division was selected as the choice of study area. At the second stage, twenty one (21) Senior Secondary Schools were chosen from the existing forty-one schools in the whole Remo division and the selected Local Government Areas based on a determined proportion of 50%, that is, four (4) schools out of eight (8) schools in Remo North L.G.A., six (6) schools out of eleven (11) schools in Ikenne L.G.A. and eleven schools out of twenty-two (22) schools in Sagamu L.G.A. At the final stage, one thousand six hundred and eighty (1680) Mathematics students were selected from the twenty one (21) selected schools based on simple random sampling, consisting of 780 male students and 900 female students. Each school has eighty chosen students (80 students/school).

Survey Instrument

Mathematics students' academic engagement scale (MSAES) and Mathematics Achievement Test (MAT) were utilized to gather information. Mathematics Student Academic Engagement Scale (MSAES) is a thirty (30) items scale adapted from the scale of Lam & Jimerson (2008). In this study, the adapted tool was changed to meet the needs of this investigation, it is made up of four (4) point type Scale with Strongly Agree to Strongly Disagree Options. Face and content validity were used to determine the instrument's validity by both Mathematics experts and experts in the department of psychology in Olabisi Onabanjo University and Tai Solarin University of Education, their contributions and suggestions were utilized to enhance the instrument's quality. The validated instrument (MSAES) was trial tested on 25 students from another school different from the sample for the research and the Cronbach's Alpha reliability coefficient was determined to be 0.776. MAT instrument is an alternative choice objective test that contained 30 items after undergoing item analysis with a first collection of 100 items designed by the researcher each item consists of four options with three diversionary choices and one critical decision. The items had been specifically drawn to cover the following areas in Mathematics: quadratic equation, mensuration, indices and logarithms, bearing, set theory, number base, series and sequence, variation. The reliability coefficient was calculated using a different sample for the investigation and the findings using the split half method, the reliability coefficient gave 0.88. The data collected were analyzed with inferential statistics of multiple regression analysis.

Results and Discussion

Results

Table 1: Regression of the Predictor Variables on Male Students' Mathematics achievement (N=780)

N	R	R ²	Model	Sum of Squares	df	Mean Square	F	Sig.
780	0.076	0.006	Regression	81.655	3	27.218	1.486	.217
			Residual	14213.845	776	18.316		
			Total	14294.845	776			

Table 1 displays the findings of the regression analysis using all three predictor variables together (emotional, behavioral, and cognitive engagements) on the sampled male students' achievement scores in Mathematics. The findings indicate an insignificant result ($F = 1.486$, $p > 0.05$). This implies that the independent variables, when considered as a whole, do not considerably explain the difference in male students' mathematics achievement. The findings reveal a multiple correlation coefficient of 0.076 and R^2 value of 0.006. This demonstrates that the combined

predictor factors accounted for only 0.6% of the variation in the dependent variable. (male students' Mathematics achievement). The null hypothesis 1 is thus accepted. Thus, the combined predictor variables do not significantly contribute to the forecasting of the mathematics performance of male senior secondary school students, accounting for less than 1% of the dependent variable's volatility. So, academic engagements are not reliable indicators of male senior secondary school students' achievement in mathematics.

Table 2: Regression of the Predictor Variables on Female Students' Mathematics Achievement (N=900)

N	R	R ²	Model	Sum of Squares	df	Mean Square	F	Sig.
900	0.138	0.019	Regression	366.446	3	122.149	5.807	.001
			Residual	18847.083	896	21.035		
			Total	19213.529	899			

Table 2 displays the findings of the regression analysis using all three predictor variables together (emotional, behavioral, and cognitive engagements) on the sampled female Mathematics test results for students. Result shows an important result ($F = 5.807$, $p < 0.05$). This suggests that the predictor variables, when considered as a whole, a substantial factor in the success gap for female students in mathematics. The findings indicate a multiple correlation coefficient of 0.138 and R^2 value of 0.019. This demonstrates that the predictor factors collectively accounted for 1.9% of the variation in the dependent variable (female students' Mathematics achievement). Therefore, the null hypothesis 2 is rejected. Consequently, the combined predictor variables play a significant role in predicting the mathematics achievement of female senior secondary school students, explaining approximately 2% of the variability in the dependent variable. So, those cognitive, behavioural and emotional engagements are important predictors of female Senior Secondary Mathematics Achievement of students in Schools.

Discussion of Results

The result of the finding revealed that cognitive, behavioural and emotional engagements, do not significantly predict the mathematical performance of male senior secondary school students. This contradicted the findings of Kessels *et al.*, (2014) that male students that are academically engaged have more achievement in academic topics like mathematics than the female students. Also, the findings showed that cognitive, behavioural and emotional engagements predict female senior secondary school students' mathematics achievement. This finding is supported by Brown and Kanyongo (2010), Robinson and Lubienski (2011) who concluded that academically engaged female students obtained better grades in Mathematics over the years.

Conclusion and Recommendation

A potential remedy for the deteriorating mathematics achievement of secondary school students is evident in student academic engagement. Therefore, it is concluded that academic engagement is a predictor variable of female mathematics achievement in senior secondary school especially in Remo division of Ogun State, Nigeria. It is recommended that academic



engagement should be employed by teachers as a means of relating with the learners in the Nigerian senior secondary schools' mathematics instruction and learning procedures.

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