Research Article

Dimensions of Students' Academic Engagement as Predictors of Senior Secondary School Mathematics Achievement

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ABSTRACT

Academic engagement has been a persistent problem and potentially more harmful to the future well-being of the educational system in Nigeria, as students show low turnout in achievement. Therefore, this study investigated behavioural, emotional and cognitive engagements as predictors of Mathematics achievement in senior secondary school. A descriptive survey research approach was used for the investigation. Sample used in the research comprised 1680 senior secondary school 2 (SS2) offering Mathematics from the twenty one randomly selected schools in the three local government areas of Ogun State's Remo division using purposive and simple random sampling technique. The instruments for the collection of data are Mathematics Student Academic Engagement Scale (MSAES) with reliability coefficient 0.776 and Mathematics Achievement Test (MAT) with reliability coefficient 0.88. Four hypotheses were developed and put to the test at a significant level using multiple regression analysis. Results indicated that cognitive engagement significantly predicts Mathematics achievement (F = 8.950, p<0.05). The study also revealed that behavioural engagement significantly contribute to the variation in learners' mathematical achievement (F = 17.474, p<0.05), Further more emotional engagement significantly contribute to the variation in learners' mathematical achievement (F = 6.393, p<0.05). Result also revealed that the predictor variables cognitive, behavioural and emotional engagement when taken together significantly contribute to the variance in students' Mathematics achievement (F = 6.205, p<0.05). This study concluded that Mathematics achievement is well predicted by student's dimension of 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

1. INTRODUCTION

According to the Federal Republic of Nigeria's 2014 National Policy on Education, education optimizes a person's creative potential and abilities for self-fulfillment and the

broader advancement of society. The learning of Mathematics, which is one of the core subjects in the National curriculum, is not only for the acquisition of knowledge and understanding of Mathematical concepts but for skills application, appreciation and interest in learners. Kulbir (2006) asserted that, only through teaching mathematics in schools can the information and skills necessary for the process of education be delivered in an efficient and systematic way. According to Oyedeji (2000), mathematics is both a process and a creative language.

Bello and Ariyo (2014) reported that the significance of mathematics cannot be overstated since it permeates almost all academic disciplines, whether they are mathematical or not, not to mention its effect on academic disciplines that are mathematically linked. According to Ifamuyiwa et al. (2018), mathematics is a topic that is common to all of the sciences, hence students are urged to enroll in science-related courses in order to further Nigeria's economic and technical growth. Despite all the universal, social, cultural, practical, and disciplinary merits of mathematics, according to Ifamuyiwa (2006), the subject nonetheless poses a danger to students at all stages of education. He further asserted that students fail Mathematics because of the nature of the subject, the level of engagement, consolidation, application, and transfer of learning are hampered by the teaching style, communication issues, and teachers' inability to connect students' immediate surroundings to their understanding of mathematics.

Students' understanding of mathematical principles and their application to real-world situations seems to be diminishing and this is of concern to stakeholders in Mathematics. Chief Examiners' Report (2014, 2016 & 2017) reveals candidates' weak performance in most of the Mathematics themes such as Algebra, Geometry, Number & Numeration, Mensuration and Trigonometry. The learning environment must promote more student engagement in order to help learners realize their potential in mathematics. It is observed that in Nigeria secondary schools today, students are not having good Mathematics achievement due to lack of academic engagement. This lack of engagement has been a persistent problem and potentially more harmful to the future well-being of the educational system in Nigeria. Hume (2011) opines that engagement is difficult to describe and much harder to quantify, but for instructors in schools, doing so is less of an issue since they can reliably tell whether a student is interested or disengaged, almost at a look, with just a little classroom experience. Academic engagement is seen as a possible antidote to the declining academic achievement of students

The idea of "academic engagement" is based on the idea that when students are curious, engaged, or inspired, their learning is often better than when they are bored. Students that are actively participating are more focused, enthusiastic, interested, and ready to learn in teaching and learning activities. Muraina et al. (2013) opined that, academic engagement is the level to which students participate in both academic and extracurricular school activities as well as identify with and value educational achievements. Vicki (2010) put another way, the phrase "student academic engagement" has historical origins in a corpus of work concerned with student participation, which is popular right now, especially in North America and Australasia, where it has been deeply ingrained via yearly significant national surveys. He went further to report the interaction between the time, effort, and other pertinent resources put forth by both students and their institutions is at the heart of student academic engagement, which aims to improve learning outcomes, student development, performance, and the institution's reputation while also maximizing the student experience. Park (2005) observes that the most pressing and ongoing concern for enhancing student learning is students' academic engagement. Student academic engagement is defined as "the quality and quantity of students' psychological, cognitive, emotional, and behavioral responses to the learning process" by Gunuc and Kuzu (2014). Also, Wei et al. (2020) reported that student

engagement has been described as a pattern of several distinctive and linked characteristics, including behavioural, cognitive, and emotional elements.

Specifically, Engagement in learning activities, effort, perseverance, and class participation all serve as indicators of behavioral engagement. The affective responses to classmates, instructors, the classroom, and school are included in emotional involvement. According to Rotgans and Schmidt (2011), cognitive engagement entails investment in learning, learning objectives, self-regulation, and planning. A student's good conduct, effort, and involvement (such as extracurricular activity participation, attendance, and work habits) are explored using the concept of behavioral engagement, which involves observable student behaviors or participation while at school (Oqab et al., 2016). According to Gunuc and Kuzu (2014), emotional involvement refers to students' reactions to the instructor, classmates, course material, and the class as a whole that all contain attitudes, interests, and values. while cognitive engagement is seen as the level of effort children are willing to put out and how long they persevere on a task, which includes doing homework, attending class, and participating in extracurricular activities and classroom discussions (Rotgans & Schmidt, 2011).

Academic engagement is crucial and advantageous for a student's abilities, successes, socializing, welfare, and overall happiness as well as for successful learning. (Wang & Eccles, 2012). Results of various studies (Appleton et al., 2008; Salmela-Aro & Upadyaya, 2014) studies indicate academic engagement is a good indicator of learning quality, school grades, test performance, and, in the long run, a good indicator of regular attendance, successful school graduation, resistance, and life satisfaction. Also according to Dunleavy et al. (2012), the three indicators of student academic engagement that have been linked to better grades in Mathematics, Language Arts, and Science are attendance, effort, and homework completion. However the three dimensions should not be considered in isolation as students may possess a singular trait of the dimensions leaving others. For example, research demonstrates that an increase in cognitive engagement aids learning and results in improved academic accomplishment in mathematics, where it is likely the most important factor for learning and development (Helme & Clarke, 2001). But the three academic engagements in all of its aspects have been deemed crucial since poor academic engagement might result in disruptive classroom behavior, emotional reactions in the children, or cognitive failure in the learner. It is on this background that this study looks at behavioural, emotional and cognitive engagement as indicators of mathematics achievement in senior secondary schools in Ogun State's Remo division. The aim of this research is to determine the degree behavioural, emotional and cognitive engagements predict Mathematics achievement in secondary school.

The 0.05 level of significance will be used to assess the following hypotheses that were developed for this investigation. **H_{01}**: Cognitive engagement will not significantly predict senior secondary school students Mathematics achievement; **H_{02}**: Behavioural engagement will not significantly predict senior secondary school students Mathematics achievement; **H_{03}**: Emotional Engagement will not significantly predict senior secondary school students' Mathematics achievement, **H_{04}**: Cognitive, Behavioural and Emotional Engagement, when taken together, will not significantly predict senior secondary school students' Mathematics achievement.

2.   MATERIALS AND METHODS

2.1.   *Design and participants*

This study used a descriptive survey research approach, sample comprises of a thousand six hundred and eighty students (1680) which were selected from twenty one (21) public

senior secondary schools in Ogun East Senatorial District (Remo Division) of Ogun state, using purposive and simple random sampling technique.

2.2. Survey instrument

Mathematics students' academic engagement scale (MSAES) and Students' responses to the Mathematics Achievement (MAT) Test were utilized to gather information. The scale consists of 30 items with 10 items each on behavioural, emotional and cognitive engagements on a four point type scale, it was validated and the reliability coefficient is 0.776, The MAT consists of 20 items to assess students' academic achievement in Mathematics. The test in question consists of 20 multiple-choice questions, each with four possible answers. The questions selected are from New General Mathematics Senior Secondary School Two (SS 2) under the following topics Quadratic Equation, Trigonometry, Polynomials, Number bases and Statistics. The reliability coefficient is 0.88. The data collected were analysed with the use inferential statistics of multiple regression analysis.

3. RESULTS AND DISCUSSION

H_{01}: Cognitive engagement will not substantially predict the mathematics achievement of senior secondary school students.

Table 1 displays the findings from the regression analysis of cognitive engagement on the respondents' ratings for mathematical achievement. The result is significant (F = 8.950, p<0.05). The finding indicates that cognitive engagement accounted for 0.5% of the variation in the dependent variable (students' achievement in mathematics), with a multiple correlation coefficient of 0.073 and an R2 value of 0.005. Therefore, the null hypothesis 1 is disproved.. Hence cognitive engagement significantly predicts senior secondary school students' mathematics achievement.

Table 1. Regression of Cognitive Engagement on Students' Mathematics achievement

Model	Sum of Squares	Df	Mean Square	F	Sig. of F
Regression	177.816	1	177.816	8.950	.003*
Residual	33339.369	1678	19.869		
Total	33517.185	1679			

Multiple R = 0.073; Multiple R^2= 0.005; Adjusted R^2= 0.005; Std. Error of the Estimate = 4.457
*indicate significant F at α = .05

H_{02}: Behavioural engagement will not accurately predict the mathematical achievement of senior high school students.

Table 2 displays the findings of the regression of behavioral engagement on respondents' scores for mathematical achievement. The results is statistically significant (F = 17.474, p<0.05). This suggests that a key factor in the variation in learners' mathematics achievement is behavioural engagement.

Table 2. Regression of Behavioural Engagement on Students' Mathematics achievement

Model	Sum of Squares	Df	Mean Square	F	Sig. of F
Regression	345.447	1	345.447	17.474	.000*
Residual	33171.738	1678	19.769		
Total	33517.185	1679			

Multiple R = 0.102; Multiple R^2= 0.010; Adjusted R^2= 0.010; Std. Error of the Estimate = 4.446
*indicate significant F at α = .05

H$_{03}$: Emotional engagement will not accurately predict how well senior high school students do in mathematics.

The impact of emotional engagement on respondents' scores for academic achievement is shown in Table 3 as a regression analysis. The finding is statistically significant (F = 6.393, p<0.05). This suggests that a key factor in the variation in students' mathematics achievement is emotional involvement.

Table 3. Regression of Emotional Engagement on Students' Mathematics achievement

Model	Sum of Squares	Df	Mean Square	F	Sig. of F
Regression	127.214	1	127.214	6.393	.012*
Residual	33389.971	1678	19.899		
Total	33517.185	1679			

Multiple R = 0.062; Multiple R^2= 0.004; Adjusted R^2= 0.003; Std. Error of the Estimate = 4.461
*indicate significant F at α = .05

H$_{04}$: Cognitive, behavioural and emotional engagements, when taken together, will not significantly predict senior secondary school students' mathematics achievement.

Table 4 displays the findings of the regression using all three predictor variables together (cognitive, behavioural and emotional engagements) on the respondents' mathematics achievement scores. The result is significant (F = 6.205, p<0.05). This suggests that the predictor factors substantially contribute to the variation in the students' mathematics achievement when considered as a whole.

Table 4. Regression of the Predictor Variables on Students' Mathematics achievement

Model	Sum of Squares	Df	Mean Square	F	Sig. of F
Regression	368.186	3	122.729	6.205	.000*
Residual	33148.999	1676	19.779		
Total	33517.185	1679			

Multiple R = 0.105; Multiple R^2= 0.011; Adjusted R^2= 0.009; Std. Error of the Estimate = 4.447
*indicate significant F at α = .05

Finding from the inferential statistics shows that cognitive engagement significantly predicts senior secondary school students' mathematics achievement, showing that the more cognitively engaged students are the more they achieve academically, this finding is in line with Helme and Clarke (2001), who reported that higher achievement in mathematics is facilitated by cognitive engagement. It is also supported by the findings of Archambault et al. (2012), that shows, students who are cognitively engaged, that is, who are prepared to dedicate time and effort to fields like science and mathematics do better academically.

The study's findings showed that behavioural engagement substantially predicts the mathematics achievement of senior high school students. This suggests that students who are persistence, involve in learning tasks and attend class regularly show more positive conduct thereby bring about positive academic achievement. This is similar to the report of Park (2005) that student engaged behaviourally won't disrupt classes, will follow instructions and be attentive thereby bring about positive achievement. In the view of Boaler (2009) reported that, although children may seem to be learning, behavioral engagement should not be considered as a way to boost achievement., This conflicts with the outcome of the research. The findings revealed that emotional engagement significantly predicts senior secondary school students' mathematics achievement, implies that the affective reactions of students to their peers, teachers and classroom with sense of belongingness brings about successful mathematics achievement which is in agreement with Salmela-Aro and Upadyaya (2014) that emotional engagement is of the key factor in achieving academic success. Finding revealed

that cognitive, behavioural and emotional engagements, when taken together, strongly predict the mathematics achievement of senior secondary school students, this shows student that are cognitively, behaviourally and emotionally engaged yielded good academic achievement which is in agreement with Dunleavy et al. (2012), they reported that many aspects of student academic engagement have been linked to better grades in mathematics, including attendance, effort, emotions, dedication, and doing assignments. Also Imaobong and Mfonobong (2013) is in support of the finding putting it that, academic engagement is a significant intellectual achievement in and of itself as it advances the achievement of the students. Similarly Wiliam (2011) and Maria et al. (2012) all put it that environments with high academic engagement classroom have a big influence on how well students do.

4.   CONCLUSION

Findings of the study lead to the conclusion that when student are cognitively, behaviourally and emotionally engaged it improved achievements in mathematics at the senior secondary level in Remo division of Ogun State, Nigerian.

Declaration of Interest
I declare that there is no conflict of interest.

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