Learning Engagement as a Predictor of Performance in Mathematics among Nigerian Senior Secondary School Students

Adeneye O. A. Awofala[a], Modiu Olaguro[b], Alfred O. Fatade[c] and Abayomi A. Arigbabu[d]

Corresponding author: aawofala@unilag.edu.ng

[a]Science Education Department, University of Lagos, Yaba, Nigeria

[b]School of Education, Virginia Tech, United States of America

[c]Mathematics Department, Tai Solarin University of Education, Ijagun, Nigeria

[d]Mathematics Department, Tai Solarin University of Education, Ijagun, Nigeria

Abstract

Learning engagement is a multifactorial paradigm that predicts content achievement. Yet, learning engagement is rarely assessed in conjunction with mathematics. Therefore, this study explored a survey of learning engagement as a predictor of students' performance in mathematics. A stratified random sampling technique was used to choose a sample of 1200 senior secondary school students from 40 senior secondary schools across the six education districts of Lagos state in Nigeria. A valid and reliable Mathematics Engagement Questionnaire (MEQ, Cronbach alpha=0.81) was used in collecting primary data related to learning engagement while secondary data related to end-of-year examination grades were collected from school records and were used to measure performance in mathematics. The results showed that there were significant associations among behavioural, affective and cognitive engagement, and performance in mathematics. In addition, affective engagement was the greatest contributor to variance in performance in mathematics ($\beta=0.935$, $p<0.001$), and this was trailed by behavioural engagement ($\beta=0.722$, $p<0.001$), and the least contributor to performance in mathematics was cognitive engagement ($\beta=-0.521$, $p<0.01$). It is the suggestion of this study that stakeholders in mathematics education should articulate policies and curricula that allow the development of cognitive, behavioural and affective engagement in order to increase and sustain students' performance in mathematics.

Keywords: learning engagement, performance in mathematics, affective engagement, cognitive engagement, behavioural engagement.

Introduction

The construct of mathematics performance is a perennial issue globally (Andertona, Hinea, & Joycea, 2017; Lysenkoa, Abramia, Wadea, Kiforob, & Iminzab, 2022). In the 21st century, the Programme for International Student Assessment (PISA) has articulated much concern for performance in mathematics at the school level (Guo & Leung, 2020). This is because most participating countries have records of low performance in mathematics. Although Nigeria is yet to participate in PISA, its records of mathematics performance at the school level as attested to by the national (Lawal & Awofala, 2019) and sub-regional (West African Examinations Council [WAEC] Chief Examiners' report, 2020) examination bodies show poor and dwindling performance. Numerous investigations have been carried out to unravel the causes of poor performance in mathematics among Nigerian students and factors such as school factors, students' factors, family factors, and teachers' factors (Awofala, 2017; Sa'ad,

Adamu, & Sadiq, 2014) have been identified. While performance in mathematics is prone to many influencing factors, prior investigations have been pre-occupied with students' factors of which the following elements have been identified: gender, demography, learning engagement and knowledge (Maamin, Maat, & Iksan, 2022). Learning engagement is a multifaceted concept frequently connected with predictors of academic performance (Baroody, Rim-Kaufman, Larsen & Curby, 2016). Prior studies have shown evidence of increasing research on the relationship between learning engagement and performance in mathematics but with the present study population, no research had been conducted. Primarily, most investigations have considered global students' performance, without restricting it to mathematics as a school subject (Chang, Chien, & Chou, 2016; Coffrin, de Barba, Corrin, & Kennedy, 2014; Tan, 2015). In addition, prior investigations did not pay attention simultaneously to the relation between students' engagement factors (cognitive, behavioural, and affective) and performance in mathematics (Lei, Cui, & Zhou, 2018). Lastly, prior investigations on learning engagement were restricted to tertiary institutions of learning (Schnitzler, Holzberger, & Seidel, 2020), with little or no attention paid to the secondary school students in Nigeria.

Consequently, this non-experimental study is composed of two major purposes:
1. To explore the association between senior secondary school students' learning engagement and performance in mathematics.
2. To explore learning engagement factors as predictors of senior secondary school students' performance in mathematics.
In Nigeria, there is a dearth of research investigating learning engagement as a predictor of senior secondary school students' performance in mathematics and this provided the needed impetus for this study. In line with the stated purposes, the following hypotheses were raised:

Hypothesis 1 (H_{01}). There is no significant association between senior secondary school students' learning engagement and performance in mathematics.
Hypothesis 2 (H_{02}). Learning engagement factors (cognitive, affective and behavioural) are not significant predictors of senior secondary school students' performance in mathematics.

Literature Review

Definitions of Learning Engagement and its dimensions
Learning engagement as a multi-layered concept encompasses several definitions. The construct of school engagement has engendered increasing awareness as a way to enhance low academic achievement, higher levels of student tediousness and estrangement, and risky attrition rates in municipal zones. Nevertheless, attempts have been made to define engagement socially or to examine it as a function of the education progression. Fung, Tan and Chen (2018) defined engagement as pupils' readiness to partake in repetitive school events, such as presence in classes, give in to mandatory work, and going by teachers' instructions in class. Once pupils are involved and inspired in school their achievement rate at school increases. Lee (2013) described engagement as strength in achievement. Engagement is the link between the individual and the action, while Tan (2015) described engagement as consisting of emotional and behavioural elements. Pupils who are committed display continued behavioural immersion in knowledge happenings shepherded by constructive emotive tenor. Such pupils choose responsibilities at the boundary of their aptitudes, execute task when provided with the chance, and apply forceful energy and attention in the enactment of educational responsibilities; they display commonly constructive passions during current achievement, together with eagerness, sanguinity, inquisitiveness, and concentration (Fung et

al., 2018). Finn and Zimmer (2012) defined engagement as involving two elements: participation and identification. To them, participation connotes the behavioural element, which consists of rudimentary actions such as the pupil's compliance to rules and regulations governing the school, getting to school and class on time, responding to the teacher, and attending to teacher-originated instructions and inquiries. The identification refers to the affective element, which denotes pupils' emotional state of fitting in the school scenery and appreciating the results that school will offer. Wang, Fredricks, Ye, Hofkens and Linn (2016) declared that the association of definite engagement actions with educational achievement is robust and reliable across people demarcated by contextual features and class level. Constructive engagement actions elucidate why some pupils achieve well in school in spite of the hardships they encounter as affiliates of risky people; meaning that they demonstrate academic resiliency. In the present study, the definition offered by the standard model of Fung et al. (2018), comprising of cognitive, emotional and behavioural elements of engagement, is taken as the operational groundwork for the investigation of engagement.

Behavioural Engagement and its Characteristics
Behavioural engagement denotes learner immersion in the educational undertaking, class attendance, and the determination to comprehend the learning (Gunuc & Kuzu, 2015). Consequently, behavioural engagement is assessed using involvement in class undertakings, the willpower to comprehend the lesson (Gunuc & Kuzu, 2015), obligation to educational activities, and devotion to the school rules (Maamin et al., 2022). Behavioural engagement denotes pupils' participation in societal, extramural, and non-theoretical school events, together with communications with other pupils (Delfino, 2019). It is engagement in the reality and survival of the school and encompasses undertaking the effort and going by the rules to partake in extramural events (Tan, 2015; Wang et al., 2016). Behavioural engagement is the degree to which learners are energetically answering to the learning tasks offered.

Learners who are behaviourally engaged ask important questions, solve job-dependent difficulties, and partake in appropriate deliberations with their colleagues and educators (Asif, Thomas, Wan & Din, 2020). Attendance in school is a major function of behavioural engagement and strong school attendance has a mutual influence on learner performance and behavioural engagement (Fung et al., 2018). Students with higher attendance rates are more likely to motivate others to graduate as attendance is a requirement for graduation. Learners must enthusiastically partake in school activities and identify with the school. Learners who have a recurring experience of school failure, do not partake dynamically and meaningfully in the class are not expected to identify with school and will possibly pull out from school (Delfino, 2019; Tan, 2015). The opposite of attendance in school which is absenteeism has been associated with unruly behavior in the class and infantile misbehavior (Finn & Zimmer, 2012). Learners who are behaviourally engaged attend classes, go to school on time and often evade unruly behavior (Finn & Zimmer, 2012) while those who experience weak affiliations and bonds to school display aberrant behaviors (Deveci & Karademir, 2019), which are deep-rooted in primary school years or prior.

Affective or Emotional Engagement and its Characteristics
Affective or emotional engagement denotes learners' replies to the teacher, colleague, and content of course, or class context (Gunuc & Kuzu, 2014). Emotional engagement promotes the learners' concentration and inquisitiveness about the learning material, with the aim of making learning fun (Maamin et al., 2022). Contrarily, the shortened proportion of affective engagement can lead to self-seclusion in pedagogical discourse (Delfino, 2019). Emotional

engagement denotes learners' dispositional responses in the classroom, which include curiosity, monotony, nervousness, despondency, and a learner's lack of identification with school (Wang et al., 2016) together with their undertaking in and affective responses to the educational tasks. Learners are emotionally engaged when they employ constructive or productively innocuous affectional reactions to an educational task (Lei, Cui & Zhou, 2018). Emotional engagement otherwise called 'engagement of the heart' denotes learners' sense of association with or disassociation from their school (Finn & Zimmer, 2012) and it is identification or proof of identity with school (Delfino, 2019). Identification is when learners have a feeling of belonging, a sense of being significant to the school, and a feeling of being treasured. Identification arises when learners sense that they are an essential element of the school context and that school constituted a vital feature of their personal practice. Identification with school could happen over time if learners partook in classroom and school events and if learners' achievements were recognized and compensated. An internalised feeling of identification may give rise to learners' dynamic involvement in class and school activities (Finn & Zimmer, 2012). Empirical proof showed that learners who had low school attendance and who have little feeling of identification with school could suffer from continuing, adversative repercussions together with unruly behavior in class, nonattendance, malingering, juvenile delinquency, and suspension from school (Finn & Zimmer, 2012).

Cognitive Engagement and its Characteristics

Cognitive engagement encompasses the enhanced comprehension and the grasp of education resources (Witkowski & Cornell, 2015). Cognitive engagement has a constructive influence on self-direction, the curiosity to study, and learners' obligation towards the education, teacher, and colleagues (Durksen, Klassen, & Daniels, 2017; Gunuc & Kuzu, 2014). Cognitive engagement is assessed by situating the knowledge goal, self-regulation, and obligation to the value of knowledge (Greene, 2015; Gunuc & Kuzu, 2014). Cognitive engagement denotes learners' undertaking in self-regulation and approaches for learning learning(Wang et al., 2016) together with the degree to which learners are engaging in and using intellectual energy in learning the tasks given to them (Gunuc & Kuzu, 2014).

Cognitive engagement concentrates principally on rendezvous in pedagogical time and with pedagogical-dependent events. It is the engagement of the mind (Durksen et al., 2017). Explicitly, cognitive engagement embraces how involved and committed learners are with assignment and teaching space deliberations and coursework, and the degree of active interaction with educational tasks and activities. Cognitive engagement ranges from unpretentious committal to memory to the use of self-regulated learning approaches that enhance profound comprehension and proficiency. Cognitive engagement is thinking outside of the box, possessing the features of tough workforces and productive surviving approaches to manage disappointment (Wang et al., 2016).

Cognitive engagement is internal mental worth and undertaking in learning that is premeditated and self-regulating (Wang et al., 2016). Premeditated learners enact several approaches when learning becomes stimulating and sometimes may propagate rehearsal, communication, and amplification (Asif et al., 2020) together with problem-solving, utilization of energy, higher-order cognitive skills, data-hunting, and research when learning becomes inspiring. Self-regulated learners according to Zimmerman (1990) have metacognitive processes as they involve themselves in planning, setting goals, organizing, self-monitoring, and self-evaluating at every stage of learning attainment. Premeditated learners engage in the management and regulation of their energy by persistence and capability to preserve their cognitive engagement (Pintrich & De Groot, 1990). Learners who

are self-regulated accept accountability and regulation for their personal understanding and expertise fulfilment. They take learning prospects with self-assurance, assiduousness, and ingenuity and are deeply conscious of their level of understanding and expertise to the extent that they seek out learning openings (Zimmerman, 1990). Sometimes cognitive engagement is linked to motivation to learn (Tan, 2015) and motivation is frequently contingent on engagement in learning events (Wang et al., 2016).

Learning Engagement and Academic Attainment
Prior investigations have shown that learning engagement is a predictor of academic attainment (Deveci & Karademir, 2019; Finn & Zimmer, 2012). Previously, the association between learning engagement and academic attainment has been investigated (Delfino, 2019) and results have been mixed. While some studies have found a significant relationship between learning engagement and performance outcomes (Maamin et al., 2022; Tan, 2015), others have found no significant relationship (Chen, Yang, Bear, & Zhen, 2013). Likewise, the marginal contribution of each engagement factor to achievement needs to be quantified. Importantly, this study determined the contribution of learning engagement to the prediction of students' performance in mathematics in the Nigerian context. This study would be the first to be conducted with a Nigerian sample.

Methodology

Research Design
This study employed a non-experimental descriptive design of a correlational type. A descriptive correlational design is a research design used to address the question of how things are related. It is a type of quantitative research design that focuses on describing and examining the relationships between variables without manipulating them. It's a non-experimental type of quantitative research. Non-experimental research is research that lacks the manipulation of an independent variable (Adeyemo, 2021).

Participants
The study's population consisted of 799 senior secondary schools in Lagos state, Nigeria. The participants consisted of 1200 year two students chosen using a stratified random sampling technique. Participant selection was based on their average performance as reported by the Lagos state Ministry of Education. More so, Lagos has the highest record of schools having underachieving students (Alade & Victor, 2013). Initially, 40 senior secondary schools from six education districts that made up Lagos State were chosen for inclusion in the study. Afterwards, identification of the percentage of schools from each district was used to determine the number of schools from each district. A total of 30 students were selected as participants for each school. Table 1 below showed the sample selected. The age of the participants varied from 14 to 20 years (Mean$_{age}$ =17 years 2 months; SD=1 year 5 months). 50% of the participants were males while the remaining 50% were females. 55% were Christian while the remaining 45% were Muslim.

Table 1. Sampling procedure and sample for the study.

District	Number of Schools Available	Percent	Number of Study Schools	Number of Students
I AGEGE	100	13	5	150
II IKEJA	160	20	8	240
III IKOYI	132	17	7	210
IV YABA	164	21	8	240

V BADAGRY	139	17	7	210
VI OSHODI	104	13	5	150
TOTAL	799	100	40	1200

Instrument

One valid and reliable instrument was used in the collection of primary data for the study. The instrument, Mathematics Engagement Questionnaire (MEQ- 21 items) adopted from Maamin, et al. (2022) anchored on a five-point Likert scale of Strongly Agree-5, Agree-4, Undecided-3, Disagree-2, and Strongly Disagree-1 was used in this study. The MEQ consisted of two sections. Section one contained biographic information connected to students' gender, school name, age, religion and level of study. Section two contained the MEQ items. The MEQ had three factors which included affective engagement (interest 3-items; exam orientation 3-items) with a reliability coefficient of 0.864; behavioural engagement (attention-3 items; perseverance 3- items) with a reliability coefficient of 0.864; and cognitive engagement (deep strategies-3 items; surface strategies-3 items; and reliance-3 items) with a reliability coefficient of 0.806 (Maamin et al., 2022). The researchers equally retrieved records pertaining to the students' performance in mathematics as secondary data on the state end-of-year mathematics examination from each participating teacher. This examination is a criterion-referenced examination designed by the Lagos State Senior Secondary Education Board to evaluate the level of proficiency of students with respect to the Nigerian new senior secondary education mathematics curriculum. In the present study, the MEQ was pilot tested with 100 senior secondary school year two students different from the study sample in order to determine the reliability coefficient of the questionnaire and through Cronbach alpha, the following reliabilities were obtained: MEQ- 21 items, $\alpha=0.807$; Affective engagement-6 items, $\alpha=0.872$; behavioural engagement- 6 items, $\alpha=0.852$; and Cognitive engagement-9 items, $\alpha=0.812$.

Data collection procedure

The Ministry of Education, Lagos state gave approval for the use of the 40 chosen schools for the purpose of data collection for the study. Twenty research assistants (one for two schools) were trained on the administration of the MEQ to the target participants for the study. Filled informed consent forms were collected from all the target respondents and all of them indicated their willingness to participate in the study. Participation was voluntary and anonymity was ensured and no participant pulled out of the study. There was no attrition in the sample as the data were collected during the time their examinations were approaching. The data collection procedure lasted for two weeks. Coding of the primary data in respect of students' engagement and secondary data in respect of students' performance in mathematics was done on SPSS version 24.

Data Analysis

The coded data were analysed using the Pearson product-moment correlation coefficient and multiple regression analysis. The level of significance for all statistical analysis was set at 5%.

Results

Hypothesis 1 (H₀₁). There is no significant association between senior secondary school students' learning engagement and performance in mathematics.

Table 2. Pearson correlation coefficient of association between learning engagement and its factors and performance in mathematics

Variables	MP	AE	BE	CE	LE
Mathematics performance (MP)	1				
Affective Engagement (AE)	0.624**	1			
behavioural Engagement (BE)	0.574**	0.585**	1		
Cognitive Engagement (CE)	-0.525**	0.462**	0.545**	1	
Learning Engagement (LE)	0.482**	0.725**	0.678**	0.542**	1

** Correlation is significant at the 0.01 level (2-tailed).

The three factors of learning engagement—affective, behavioural and cognitive—were investigated to detect the association among them and performance in mathematics, and to detect the forecasters of engagement that most impact performance in mathematics. In line with the Pearson correlation analysis, there was a weighty association between mathematics engagement and performance in mathematics (r = 0.482, p<0.05). Moreover, all associations were significant between affective engagement (r = 0.624, p<0.05), behavioural engagement (r = 0.574, p<0.05), cognitive engagement (r = -0.525, p<0.05) and performance in mathematics. All the associations were statistically significant, but high. Thus, there was a significant association between senior secondary school students' learning engagement and performance in mathematics. The null hypothesis was hence rejected.

Hypothesis 2 (H_{02}). Learning engagement factors (cognitive, affective and behavioural) are not significant predictors of senior secondary school students' performance in mathematics.

The outcomes of the multiple regression scrutiny demonstrated that significant associations amid affective, behavioural and cognitive engagement occur with performance in mathematics, as shown in Table 3. The ANOVA regression analysis (Table 3) revealed a significant association between affective, behavioural and cognitive engagement with performance in mathematics ($F_{(3, 1196)}$ = 122.015, p=0.000). The three factors investigated contributed as much as 84.3% variance to performance in mathematics.

Table 3. Multiple regression analysis of learning engagement factors and performance in mathematics

Model summary
Multiple R= .918
Multiple R^2= .843
Multiple R^2 (Adjusted)= .842
Standard Error Estimate= 5.002
F=122.015
p<.001
df1=3
df2=1196

Variable	Unstandardized coefficients		Standardized coeff.	t	Sig
	B	**Std Error**	**Beta**		
Constant	0.401	.123		11.221	.000
Affective engag.	0.935	.085	0.752	34.228	.000
Behavioural engag.	0.722	.062	0.535	19.001	.000

Cognitive engag.	-0.521	.043	-0.452	-10.542	.000

As shown in Table 3, the affective engagement recorded the greatest beta (β) value (0.752), trailed by behavioural engagement (β=0.535), and the least was cognitive engagement (β=-0.452). The equation of the regression analysis is depicted as: Achievement = 0.401 + 0.935 Affective Engagement + 0.722 behavioural Engagement - 0.521 Cognitive Engagement. The equation shows that one unit increase in affective engagement will lead to a 0.935 increase in performance in mathematics. One unit increase in behavioural engagement will lead to 0.722 increase in performance in mathematics. Lastly, one unit increase in cognitive engagement will lead to 0.521 decrease in performance in mathematics.

Discussion

The present study investigated the association, using a multifactorial paradigm of learning engagement—affective, behavioural, cognitive—and performance in mathematics. The principal predictor of the learning engagement factors that impact performance in mathematics was likewise investigated. The study results indicated that there was a significant association between each factor of learning engagement—affective, behavioural and cognitive—and senior secondary school students' performance in mathematics. Specifically, there were positive associations between two of the factors of learning engagement with performance in mathematics.

These outcomes are much more significant for the mathematics education domain (Maamin et al., 2022) in Nigeria. As recorded in this study, learning engagement is a strong factor in students' performance in mathematics. This is because improved cognitive, behavioural and affective engagement can increase and promote students' performance in mathematics. These outcomes are conflicting with prior investigations (Ayub, Yunus, & Mahmud, 2018). The positive association between performance in mathematics and behavioural engagement shows that diligence and attention in the mathematics classroom are very important for meaningful students' performance in mathematics (Spann, Yu, Galla, Duckworth, & D'Mello, 2020). Students' diligence and attention in the mathematics classroom can serve as a booster of their performance in mathematics. Compared with their counterparts who show low attention and diligence, students who display high attention and are diligent in mathematics classrooms record the greatest performance in mathematics (Bester & Brand, 2013). Students who are diligent make resolutions to be successful in mathematics classrooms as they try to comprehend difficult mathematics questions by using several approaches to arriving at solutions to them. Students who display this behavior will possess the motivation to learn mathematics (Awofala & Falolu, 2017; Awofala, Lawani & Adeyemi, 2020). Teachers can be of help in increasing students' motivation by using pedagogical strategies that rely on technology (Bester & Brand, 2013). Hilla, Sharma and Xu (2017) found that the integration of blended learning into a large first year university physics course resulted in a high frequency of student engagement, despite a gradual decrease in participation across the semester.

In addition, the present study revealed that affective engagement was positively and significantly associated with senior secondary school students' performance in mathematics in which the two indicators of affective engagement are examination orientation (Guo & Leung, 2020) and interest in mathematics (Wong & Wong, 2019). This result agreed with the findings of Maamin et al. (2022). Students who show interests in mathematics will be happy

to learn mathematics, will enjoy learning it and will love solving problems. Students with good examination orientation will be happy to get good mathematics results and will be satisfied when efforts reflect good mathematics results. Nevertheless, it has been confirmed that there was no significant association between mathematics interest and performance in mathematics (Maamin et al., 2022).

Succinctly, there was a significant negative association between senior secondary school students' performance in mathematics and cognitive engagement. This result coincided with the findings of (Maamin et al., 2022). Clearly, approaches to learning and reliance on teachers showed negative influence on students' performance in mathematics. Hence, students should use appropriate approaches to learning and minimize their reliance on teachers, to increase and sustain their performance in mathematics. While some investigations had revealed the efficacy of deep strategy in increasing students' performance in mathematics (Maamin et al., 2022), others had indicated that deep strategy did not improve students' performance in mathematics (Guo & Leung, 2020).

One other objective of the present study was to assess the greatest predictor of the learning engagement factors that impacted senior secondary school students' performance in mathematics. The affective engagement was investigated to be the greatest predictor influencing senior secondary school students' performance in mathematics. While this result conformed to the prior studies' results (Maamin et al., 2022), it showed variance with some other studies (Ayub et al., 2018). Maamin et al (2022) showed that affective engagement was the best predictor of mathematical achievement while others showed that cognitive engagement was the best predictor of achievement in mathematics (Ayub et al., 2018; Fung et al., 2018). Yet students' affective engagement, which is important for students' continued interest and learning outcomes, is under researched (Bhansali & Sharma, 2019). Two indicators of affective engagement that are very important in mathematics learning in this study are interest in mathematics and exam orientation. Students who show interest in mathematics learning will be motivated to learn mathematics and hence will increase their performance in mathematics. Motivation and interest work concurrently in inducing academic performance (Maamin et al., 2022).

Interest influences the paths by which students learn and study to increase their performance in mathematics (Wong & Wong, 2019). Hence, it is vital for mathematics teachers to improve students' level of interest in mathematics in order to increase their performance in mathematics. Students who show interest in mathematics learning will set achievable goals in mathematics examinations that will positively impact their performance in mathematics. The onus is on the mathematics teachers to use learner-centred instructional strategies capable of increasing students' interest in mathematics. This is because teachers who adopt diverse instructional methods improve students' engagement in mathematics (Asif et al., 2020). Teachers should desist from using teacher-centred instructional method, which is common practice in Nigeria (Awofala & Lawani, 2020a) and has been found to impact students' performance in mathematics negatively (Lawal & Awofala, 2021). Evidence suggests deterioration in students' interest and performance in mathematics as a result of the adoption of teacher-centred instructional method (Awofala & Lawani, 2020b).

Approaches to learning (deep and surface learning) and dependence on teachers are two indicators of cognitive engagement that influence students' performance in mathematics in this study. Cognitive engagement negatively predicted students' performance in mathematics. Students will find learning of mathematics difficult if they: prefer to commit to memory all

the formulas needed to obtain solutions to problems, see memorization of formulas as the best technique for learning mathematics, and think that the best way to learn mathematics is to try to do drills. Such students will learn mathematics at the surface level and little or no understanding will be gained. Likewise, students who learn mathematics based on what the teacher teaches, solve mathematics problems in the same way taught by the teacher, and think the best way to learn mathematics is to follow the teacher's instructions will end up not being able to transfer knowledge gained to solving novel problems that are differently molded from teachers' questions in the classroom. Students who relate concept learnt in mathematics to the things they go through in real life, relate the concepts they learnt in mathematics to other subjects, and think about the concepts they have learnt when they are learning new things in mathematics will be able to transfer learnt content to solving novel problems and will show high conceptual understanding of mathematics that will improve their procedural fluency and enhance their adaptive reasoning in mathematics (Awofala, 2017). Such students will be able to show high strategic competence in solving mathematics problems and will view mathematics as a useful subject to increase their productive disposition in mathematics thus becoming mathematically proficient.

Conclusions

The present investigation has shown that learning engagement was associated with performance in mathematics. Specifically, there was a significantly positive association between affective engagement, behavioural engagement and performance in mathematics. In contrast, there was a significant and negative association between cognitive engagement and performance in mathematics. More so, affective engagement was the best and the greatest contributor to the explanation of variance in senior secondary school students' performance in mathematics. This does not mean that other engagement factors (behavioural and cognitive) are not important in predicting students' performance in mathematics. Within affective engagement, students' examination orientation and interest in mathematics are important indicators of performance in mathematics. These indicators must be boosted to increase students' achievement in mathematics. Students should see mathematics as enjoyable, entertaining and pleasurable to be affectively engaged in mathematics. They should have clear targets and orientation towards mathematics examinations in order to induce adequate preparation for them. Adequate support must be provided and shown by relatives, colleagues and teachers to make students have a good disposition towards mathematics. Clearly, all the three factors of learning engagement should be considered important by mathematics educators and researchers because the three factors are indispensable in making mathematics learning more meaningful and sustainable.

One major limitation of this study was that observation and interview were not used to triangulate the findings on the association between learning engagement and performance in mathematics. Thus, researchers in this area should consider using qualitative methods, such as student and teacher interviews and classroom observation, as a means of evaluating and extending this research. This suggests that activities that increase student interest in mathematics and create a positive orientation towards exams may increase student achievement in mathematics.

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