Self–Regulatory Attributes and Academic Performance in Mathematics among Secondary School Students in Enugu Education Zone, Enugu State

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Abstract

This study investigated self-regulatory attribute and academic performance in Mathematics among secondary school students in Enugu Education Zone using path analysis. Specifically, the study investigated the relationship between self-regulatory attributes and academics performance in Mathematics. The study also investigated the combined and combined and relative predictive impact of self-regulatory attributes on students' academic performance in Mathematics. The study adopted correlational research design. The sample for the study comprised of 442 SS2 students (209 males and 233 females) randomly selected from 16 secondary schools in the area. The instruments used in data collection for the study were "Self-Regulatory Attributes Questionnaire" (SRAQ) and Mathematics Achievement Test (MAT). The data collected were analyzed using Multiple Linear Regression analysis tested at .05 level of significance. The results revealed that self-regulatory attribute variables had a significant relationship with academic performance in Mathematics. The results further revealed that self-regulatory attribute variables are collective and individual predictors of academic performance in Mathematics. It was recommended among others, the school counsellors should inculcate values such as confidence, competence, effective use of time, good organization and so on among the students so as to reduce the attitude of not performing tasks as at when they have to.

Keywords: Self-regulatory, academic performance, Mathematics.

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INTRODUCTION

Education is seen by the Federal Republic of Nigeria in her Education Policy as an instrument par excellence in affecting national development of the country. According to Lawer, Isaac, Seth and Nashiru (2016), education is the second item on the Millennium Development Goals and a key priority of every government, and the most important investment a country can make in its people for better development. Through education activities offered in schools, the students are expected to acquire technical and vocational skills that are necessary for economic development. Also, the school, through its teachers is required to developed and promote a desire in the students for self-improvement, with the aid of Mathematics knowledge and overall achievement of excellence.

According to Igiri (2013), the role of Mathematics in the field of science and technology is enormous and cannot easily be over-looked and that it is essentially a dynamic science, which serves as the underlying knowledge for science and technology. Because of the importance of Mathematics, the Federal Government of Nigeria made it a compulsory subject at the primary and secondary levels of education and a basic requirement for admission into most science courses at the tertiary level of education. Despite all the emphasis laid on Mathematics, performances in the subject has remained consistently low in sub-Sahara Africa. Its teaching and learning have become illusive in Nigeria, where majority of teachers teaching Mathematics are not mathematically trained (Ekuri & Offiah, 2013). The students in Enugu Education Zone are not left out in this poor performance in Mathematics. Regrettably, evidences from previous poor achievements among senior secondary school students nationwide in the National Mathematics Examinations; the West African Senior School Certificate Examination (WASSCE) indicates that these advantages look illusive. This can be seen in the past results in the WASSCE from 2010 to 2016, where only relatively low percentage of students (33.55%, 38.93%, 49.00%, 36.00%, 31.30%, 34.18 and 38.68%) obtained credit and above. This causes tremendous consequences on the students' understanding, learning and performance in the national examinations. The Nigerian governments trying to capture the circumstance through some instructive organizations have attempted to enhance students' achievement by introducing new administration plans and activities, new educational programs bundles, and so on. However, every one of these trials have not created critical constructive outcome.

No doubt, Mathematics has attracted the attentions of both State and Federal Governments and even multinational organizations at the expense of other subjects through State and National Mathematics quiz competitions. Yet meaningful solutions have not been reached to curb poor performance in Mathematics among students. The use of various techniques in teaching Mathematics by the teachers would have no doubt solved the problem of poor performance in the subject. But, is it that teachers are not committed or they are not applying appropriate techniques to prepare the mind of the students? Many researchers have pointed accusing fingers of the failure on teachers. It can be seen that the same teachers who produced the best students also produce those that failed. This scenario indicates that there are other factors apart from the teacher factor, which can be attributed to the students themselves, characterized as self-regulation.

Self-regulation is the processes by which people regulate their thoughts, emotions, attention, behaviour and impulses. People generate thoughts, feelings and actions and adapt those to the attainment of personal goals. Behavioural self-regulation involves self-observing and strategically adjusting performance processes, such as one's method of learning (Beishuizen & Steffens, 2011; Lyn, Cuskelly, O'Callaghan & Grey, 2011). Individuals regulate their own functioning in order to achieve goals or change how they are thinking. The self-regulation of cognition and behaviour are important aspects of learning and the extent to

which school students become self-regulators of their own learning influences their academic success (Zimmerman, 2008; Zimmerman & Schunk, 2011).

Furthermore, Zimmerman and Kitsantas (2005) have suggested a four stage process. In the first stage, learners acquire self-regulatory skills and strategies most rapidly from social sources such as observing the processes being modelled, verbal descriptions and social guidance, and feedback. An imitative level of self-regulatory competence is reached when the learner's performance emulates that of the observed model. The internalization of the strategy is the next stage and is apparent through the ability of the learner to use the strategy independently. Someone's actions and mental processes depend on one's beliefs and motives.

According to Soleymani and Rekabdar (2016), life in today's modern and complicated world requires creative thoughts and dynamic ideas. They further observed that learning Mathematics effectively can help it to form and grow well and that studying the effective parameters in learning Mathematics has been attractive to many scientists in the field of education during recent decades. Several researches have been carried out and the results pointed to the fact that understanding Mathematics not only depends on cognitive structures, but also on motivational and emotional factors such as belief, attitudes and anxiety. The effect of self-regulation on academic achievement has been researched in conjunction with motivational factors, for example, self-efficacy, achievement objective introduction, and learning techniques (Bartels & Magun-Jackson, 2009; Pintrich & Schunk, 2002).

Learning is as much a function of a person's emotional response to a learning environment as it is to the instructional method or classroom (Eshum, 2013), while Intelligence Quotient (IQ) has long been used as a predictor of a student's success. As the world enters the 21st century, research shows that emotional intelligence (EI) is a better predictor of "success" than the mere traditional measures of cognitive intelligence. EI is one such factor which is instrumental in situations that call upon students to adjust successfully from one environment to another. Emotional intelligence skills are vital to human performance and the management of successful learning organizations. Promise (2014) stated that emotional intelligence plays a key role in determining success in school, business arena, career pursuit as well as life generally.

A growing body of literature supports the relationship between students' self-efficacy beliefs for academic tasks and their academic performance. Self-efficacy refers to the judgments of a person's capabilities, and it is a capability to carry out the actions needed to succeed in a task. It is one of the strongest factors predicting performance in domains as diverse as sports, business, and education. Klassen, Krawchuk and Rajani (2008) believed that self-efficacy strongly influences our task, choice, level of effort, persistence, and resilience. That in academic settings, self-efficacy is a strong predictor of performance. Some researchers (Lilian, 2012; Paul & Gore, 2006) have investigated the role that academic self-efficacy beliefs play in predicting college success. They suggested that a positive relationship could be observed between these two variables.

The concept of motivation is closely related to other constructs in education and psychology. They include attention, needs, goals and interests which all focuses on stimulating individual learners and rising their interest and attention towards engaging in an action or behaviors and the accomplishment of such actions or goals (Krause, Bochner, & Duchesne, 2003). The concept of motivation is also said to be functional when an individual is thrilled to satisfy some need or desire. The individual will involve in, or be attracted toward actions that are perceived as having the possibility to meet this need or desire (Tan, Parsons, Hinson, & Sardo-Brown, 2003).

The concept of learner autonomy has been constantly viewed as "a problematic term" or "a slippery concept because it is difficult to define precisely". Various attempts have been

made to identify adequately the meanings that underpin learner autonomy. The difficulty of arriving at a clear definition for the term stems from its multidimensional aspect (Benson, 2001; Paiva, 2011). In this respect, Little (2015) evokes the ambivalent borderline of learner autonomy when he argues that the rapidly expanding literature has debated. For example, whether learner autonomy should be thought of as capacity or behaviour; whether it is characterized by learner responsibility or learner control; whether it is a psychological phenomenon with political implications or a political right with psychological implications; and whether the development of learner autonomy depends on complementary teacher autonomy. Despite the confusions revolving around learner autonomy because of a missing unique and universal theory of autonomy, Murphy (2011, p. 17) maintains that at least "there is agreement on the educational importance of developing autonomy and that autonomy can take a variety of forms, depending on learning context and learner characteristics".

Academic procrastination seems to be prevalent in academic settings, where students tend to delay their tasks without valid excuses and submit their assignments at the last minute before the deadlines. The cognitive component of procrastination involves the discrepancy between intentions and actual behaviour. A substantial body of empirical literature supports the prevalence of academic procrastination as a self-perceived problem for college students, with consequences ranging from reduced academic achievement to substantially increased stress and poor quality of life (Ocal, 2016; Haghbin, McCaffrey & Pychyl, 2012). Procrastination is considered as one of the most serious problems in daily life and educational settings in modern societies.

Several studies have been conducted and their results show that understanding Mathematics does not only depend on cognitive structures, but also on motivational and emotional factors such as belief, attitudes and anxiety. The impact of self-regulation on academic achievement has been investigated in conjunction with motivational variables, such as self-efficacy, achievement goal orientation, and learning strategies using univariate statistics (Bartels & Magun-Jackson, 2009; Pintrich & Schunk, 2002). There is a need to further investigate how self-regulatory attributes can individually and collectively predict academic performance in Mathematics among secondary school students in Nigerian setting.

Statement of the Problem

Poor performance of students in Mathematics is of serious concern to government and parents, especially when considered against the resources spent each year in training and retraining of teachers. The use of various approaches and strategies in teaching Mathematics would have no doubt solved the problem of poor performance in the subject. Yet no meaningful solutions have been reached to curb poor performance in Mathematics among students especially, in the West African Senior School Certificate Examination. It can be seen that the same teachers who produced the best students are also being accused by those that failed. This shows that there are other factors apart from the teacher effects which can be attributed to the students themselves.

Several studies have been carried out on the relationships or effects of various psychological and social variables such as emotional intelligence, self-esteem, learner autonomy, achievement motivation, among others on students' academic performance. The results of these studies varies from one to the other, yet some gaps still exist in the area of the possible effect of some of these self-regulatory attributes namely (emotional intelligence, self-esteem, self-efficacy, achievement motivation, learner autonomy and academic procrastination) on Mathematics performance of secondary school students in Nigeria.

Purpose of the study

Specifically, the study investigated the following:

- The relationship between the self-regulatory attributes (emotional intelligence, self-esteem, self-efficacy, achievement motivation, learner autonomy and academic procrastination) and students' academic performance in Mathematics.
- The combined and relative predictive impact of self-regulatory attributes on students' academic performance in Mathematics.

Research Questions

The following research questions guided the study:

- What is the relationship between self-regulatory attributes (emotional intelligence, self-esteem, self-efficacy, achievement motivation, learner autonomy and academic procrastination) and students' academic performance in Mathematics?
- What is the combined and relative predictive impact of self-regulatory attributes on students' academic performance in Mathematics?

METHODOLOGY

Research design

This study was an ex-post facto research. The relationship among Self-regulatory attributes (emotional intelligence, self-esteem, self-efficacy, achievement motivation, learner autonomy and academic procrastination), and academic performance in Mathematics among students was evaluated, as they existed. There was therefore no manipulation of the variables since the variables have already manifested in the population before the study.

Subjects and Measures

The sample for the study comprised of 442 SS2 students (209 males and 233 females) randomly selected from 16 secondary schools in the area. The instruments used in data collection for the study were "Self-Regulatory Attributes Questionnaire" (SRAQ) and Mathematics Achievement Test (MAT). The reliability of the SRAQ was determined using Cronbach Alpha reliability method which gave a reliability coefficient that ranged from .72 to .85 and the MAT was analyzed using Guttman split-half reliability estimate which gave a coefficient of .75 with Spearman Brown prophesy coefficient of .76 for the first reliability.

Data collection and analysis

Data collection was done in the sampled schools by the researcher with the assistance of the Mathematics teachers available in the selected schools. The data collected were analyzed using Multiple Linear Regression analysis tested at .05 level of significance.

PRESENTATION OF RESULTS

Research Question One

What is the relationship between self-regulatory attributes (emotional intelligence, self-esteem, self-efficacy, achievement motivation, learner autonomy and academic procrastination) and students' academic performance in Mathematics? The inter-correlation coefficient among the variables is presented in Table 1.

Table 1: Descriptive statistics and Inter-correlation among the variables (N=442)

Variables	Mean	SD	1	2	3	4	5	6	7
Academic performance	12.76	4.96	1.000						
Emotional intelligence	17.45	4.05	.520*	1.000					
Self esteem	17.79	3.98	.478*	.641*	1.000				
Self-efficacy	16.34	3.16	.409*	.343*	.336*	1.000			
Achievement motivation	17.81	3.33	.352*	.288*	.370*	.349*	1.000		
Learner autonomy	17.99	3.41	.467*	.666*	.511*	.363*	.245*	1.000	
Academic procrastination	13.24	3.68	-.293*	-.181*	-.218	-.325*	-.262*	-.203	1.000

*Significant at .05 level of significance. R = .447.

The result in Table 1 showed that the mean scores obtained among the subject as regards to their emotional intelligence, self-esteem, self-efficacy, achievement motivation, learner autonomy and academic procrastination were 17.45, 17.79, 16.34, 17.81, 17.99 and 13.24 respectively while their mean performance in the Mathematics achievement test was 12.76. The result in Table 1 further showed that the inter-correlation among the variables revealed that all the independent variables excluding academic procrastination had significant positive relationship with each other and academic performance in Mathematics while academic procrastination had a significant negative relationship with other variables and academic performance in Mathematics.

Research Question Two

What is the combined and relative predictive impact of self-regulatory attributes on students' academic performance in Mathematics? The composite contribution of all the independent variables on academic performance in Mathematics was checked and the result was presented in Table 2.

Table 2: Multiple Regression Analysis showing the combined predictive impact of self-regulatory attributes and academic performance in Mathematics

Multiple R	=	0.623
Multiple R^2	=	0.388
Multiple R^2 (Adjusted)	=	0.380
Standard Error of Estimation	=	3.908

Source of variance	Sum of squares	df	Mean square	F-ratio	p-level
Regression	4213.233	6	702.205	45.986*	.000
Residual	6642.378	435	15.270		
Total	10855.611	441			

*Significant at .05 level.

The result in Table 2 showed that the analysis of variance of the multiple regression data yielded an F-ratio value which was statistically significant at .05 level of significance; $F_{(6, 435)}$ = 45.986. This result indicates that when the independent variables when taken together, they significantly predicted students' academic performance in Mathematics. The combined contributions of the independent variables to students' academic performance in Mathematics produced a coefficient of multiple regression (R) of 0.623 and an adjusted (standardized) multiple R-square (R^2) of 0.380. The adjusted multiple R-square (R^2) of 0.380 implies that when the independent variables were taken together, they accounted for 38.0% of the total variance in students' academic performance in Mathematics.

To find out the relative contributions of each of the independent variables to the students' academic performance in Mathematics, a test of regression weight was carried out and the result was presented in Table 3.

Table 3: Test of regression weights for contributions of each of the self-regulatory attributes on students' academic performance in Mathematics

Variables	B	Std. Error	Beta	t	p-level
(Constant)	-3.924	1.823		-2.152*	.032
Emotional intelligence	.288	.070	.235	4.122*	.000
Self-esteem	.175	.064	.141	2.750*	.006
Self-efficacy	.246	.068	.156	3.602*	.000
Achievement motivation	.174	.063	.117	2.775*	.006
Learner autonomy	.189	.075	.130	2.514*	.012
Academic procrastination	-.150	.054	-.112	-2.761*	.006

Dependent variable: Students' academic performance in Mathematics.

Table 3 shows the standardised regression weights (beta), t-ratio and probability level for each of the variables. As presented, the standardised regression weights (Beta) obtained for the independent variables were 4.122, 2.750, 3.602, 2.775, 2.514 and -2.761 for emotional intelligence, self-esteem, self-efficacy, achievement motivation, learner autonomy and academic procrastination respectively in students' academic performance in Mathematics. In terms of magnitude of the contribution: emotional intelligence contributed most to the prediction of students' academic performance in Mathematics followed by self-efficacy, self-esteem, learner autonomy, achievement motivation and academic procrastination respectively.

DISCUSSION

The result revealed that all the self-regulatory attributes excluding academic procrastination had significant positive relationship with each other and the academic performance in Mathematics while academic procrastination had significant negative relationship with other variables and the academic performance in Mathematics. The result also revealed that the combined contribution of self-regulatory attributes produced an F-ratio of 45.986 with a p-value of .000, which is statistically significant at .05 level of significance. This result indicated that self-regulatory attribute variables are significant predictors of academic performance in Mathematics among secondary school students in Enugu Education Zone.

Self-regulatory attribute variables produced a coefficient of multiple Regression (R) of .623, a multiple R-square (R^2) of .388 and an adjusted (standardized) R^2 of .380. The adjusted (standardized) R^2 of .380 implies that self-regulatory attribute variables accounted for 38.0 percent (38.0%) of the variance in the academic performance of students in Mathematics.

The result indicated that emotional intelligence had the greatest prediction in academic performance in Mathematics followed by self-efficacy, self-esteem, learner autonomy, achievement motivation respectively with academic procrastination having the least prediction on academic performance in Mathematics which is negative. The finding is not surprising because self-regulatory attributes have a great role for better academic performance in Mathematics in such a way that students who make positive use of these attributes will be more serious with their studies and will definitely perform better than those who do not make meaningful use of these attributes.

The finding as regards emotional intelligence is in agreement with researchers such as Carvalho and Colvin (2015), and Yelkikalan, Gungor, Kiray and Cetin (2014) who found out that there is significant relationship between emotional intelligence and academic achievement among adolescents in a manner that students with high emotional intelligence indicate preferable academic performance over the students with low emotional intelligence but the finding is in contrary with the studies by Chen and Lai (2015) and Eni-Olorunda and Adesokan (2015).

The finding as regards to self-esteem is in consensus with the studies by Bahrami and Bahrami (2015), Ghodrati, Tavakoli, Heydari and Akbarzadeh (2016) and others who uncovered that there is a significant positive relationship between self-esteem and students' academic performance which they suggested among others that educators ought to give circumstances of achievement to all students that this will enhance students' feeling of self-esteem, but Lawer, Isaac, Seth and Nashiru (2016) are on a contrary note that self-esteem has no significant effect on academic achievement.

Based on self-efficacy, the finding is in agreement with the studies by Hassan, Alasmari and Ahmed (2015), Kirmizi (2015), and many others who are of the opinion that there is a significant positive relationship between self-efficacy and academic achievement while the studies by Balami (2015), and Simbulas (2014) disagreed to as they uncovered that there is no significant relationship between students' self-efficacy scores and academic performance.

In respect to achievement motivation, the finding is in accordance with many researchers such as Affum-Osei, Adom, Barnie and Forkuoh (2014), Muhammad, Bakar, Mijinyawa and Halabi (2015) and many others who revealed that achievement motivation has a great impact with students' academic performance and can also predict students' academic performance which they concluded that academic achievement increases with the increase in achievement motivation while the study by Bakar, Tarmizi, Mahyuddin, Elias, Luan and Ayub (2010) indicated a negative significant correlation between achievement motivation and students' academic achievement. The studies by Onete, Edet, Udey and Ogbor (2012), and Veena and Shastri (2013) were of the opinion of absence of significant difference in achievement motivation between high and low achievers. As regards to learner autonomy, the finding is in line with the studies by Farhad and Roghayyeh (2016), Iji and Wuave (2014), Negari and Donyadary (2013) and many others who are of the opinion that a significant positive correlation exists between learners autonomy that the learners assumed the liability of their learning.

Finally, as regards to academic procrastination, the finding is in agreement with the studies by Hajali and Javad (2015), Kim and Seo (2015), Rafii, Saremi, Najafi and Haghani (2014), and many other researchers who found out that there is a significant negative correlation between academic procrastination and students' academic achievement that

expansion in academic procrastination will diminish academic achievement and self-efficacy and this is in contrary to the studies by Eni-Olorunda and Adesokan (2015), and Sepehrian and Hosaeinzadeh (2012) who demonstrated that there was no significant relationship between academic procrastination and academic achievement.

CONCLUSION

Based on the results of the study, it was concluded that self-regulatory attribute variables collectively significantly predicted academic performance in Mathematics among secondary school students in Enugu Education Zone Emotional intelligence had the greatest prediction followed by self-efficacy, self-esteem, learner autonomy, achievement motivation and academic procrastination respectively.

Policy Implications

It was recommended that the school authorities as a matter of urgency should give attention in developing the individual's emotional intelligence skills and achievement in Mathematics by establishing emotional intelligence training programmes in the school. Students should be tasked with periodical autonomous problem solving activities in Mathematics and encouraged to complete assignments within time lines. The school counsellors should inculcate values such as confidence, competence, effective use of time, good organization and so on among the students so as to reduce the attitude of not performing tasks as at when they have to.

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