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EXAMINING SECONDARY SCHOOL STUDENTS' SELF-DIRECTED LEARNING, SELF-REGULATED LEARNING STRATEGY AND ACADEMIC SELF-CONCEPT AS PREDICTORS OF ACADEMIC ACHIEVEMENT IN MATHEMATICS IN ANAMBRA STATE, NIGERIA

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ABSTRACT

Students' self-directed learning, self-regulated learning strategy and academic self-concept are strong adaptive learning behaviours for academic achievement. The study aimed to examine students' social goal orientation and self-regulated learning strategies as predictors of academic achievement in Anambra State. Four research questions and three null hypotheses guided the study. The study adopted a predictive correlational design to provide answers to the research questions. The population of the study comprised of 21204 SS II from which a sample of 660 was drawn. Multi-stage procedure was used to select the sample. Two standardized research instruments namely; Self-Description Questionnaire (SDQ), Self-directed Rating Scale (SRS) and Motivated Strategies for Learning Questionnaire (MSLQ), as well as score from students' promotional examination were used for data collection. Cronbach's alpha was used to determine the reliability of the items in the instruments. A reliability index of 0.87, for academic self-concept; 0.76, for elaboration; 0.67, for organization; 0.70, rehearsal; 073, for monitoring; 0.81, for planning, 0.72, for self-regulation; 0.74, for self-awareness; 0.84, for learning activity; 0.87, for interpersonal skills and 0.68, for self-evaluation respectively. The standard multiple regression was used to analyze the collected data. The t-test for r, F-test and test of significance for β, were used to test hypotheses at .05 level of significance. Findings recorded that the seven assumptions that were tested in the study were statistically fit to predict the regression model. Findings from the study indicated that, the self-direct learning, self-regulated learning strategy and academic self-concept scores jointly and significantly predicted academic achievement scores in mathematics. Basedon the significant prediction which self-directed learning, self-regulated learning strategy and academic self-concept had recorded on students' academic achievement scores in mathematics, it was recommended that teachers should advice the students to make use

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of their self-directed learning, self-regulated learning strategy and academic self-concept in the learning process so that their level of confidence to predict academic achiement scores will be high.

Keywords: Self-Directed Learning, Self-Regulated Learning Strategy, Academic Self-Concept and Academic Achievement.

Introduction

Positive academic achievement of the students emphasizes the significance of social and psychological factors that facilitate key learning outcomes. Emergence of this ideas has led to empirical investigations which focused on the non-cognitive constructs that serve as antecedents of cognitive outcome. The three notable psychological variables that had been linked to a wide range of academic outcome are self-directed learning, self-regulated learning strategy and academic self-concept. Findings from the past investigations provide strong support to the notion that self-directed learning, self-regulated learning strategy and academic self-concept have direct impact on students' academic achievement (Anyanwu, Ezenwosu & Emesi, 2022; Emesi, Anyanwu, & Ezenwosu, 2022; Anyanwu, &Emesi, 2021; Anyanwu, &Emesi, 2020; Niepel, Brunner, &Preckel, 2014).

The present study is an extension of the aforementioned studies that failed to examine the predictive nature of independent variables of the study on the students' academic achievement scores. Empirically, examining the relative roles of self-directed learning, self-regulated learning strategy and academic self-concept that could influence the students' reasons to proactively approach learning is critical in the present study. For example, Hiemstra (1994) defined self-directed learning as a process in which learners are responsible for planning, implementing and evaluating their own learning and are expected to work independently or with others, in order to achieve pre-set learning goals. This indicates that students entering into educational programmes without having the self-directed learning skills, could experience learning anxiety, frustration and often unexpected academic failure.

Interestingly, the study of Knowles (1975) as cited by Williamson (2007) explained that self-directed learners are proactive to take the initiative in learning rather than to be passively waiting to be taught as reactive learners. That is, the learners age usually contributes to the learning process with the help of self-awareness and interpersonal skills that could facilitate collaborative learning. On this note, their learning experience is more meaningful and purposeful, with greater motivation resulting in longer retention. Learners that endorse self-directed learning are more responsible in their own lives having benefited from the self-disciplining process of their learning. Actually, Williamson's study has categorized the construct of self-directed learning into four clusters such as; awareness, learning activity,

evaluation and interpersonal skills. Awareness is related to learners' understanding of the factors contributing to becoming self-directed learners. Learning activities are specifying the requisite learning activities which learners should actively engage with in order to become self-directed in their learning processes. Evaluation on its own reveals learners' specific potential attributes which learners employ in order to help monitor learning activities. Interpersonal skills deal with relating to learners' skills through interpersonal relationships, which are pre-requisite to their becoming self-directed learners. Operationally, the researchers defined self-directed learning as self-planned learning technique which involves independent learning and collaborative learning style that represent a reflective learning behaviour. Examining the assumption that students' self-directed learning could influence their academic self-concept and self-regulated learning strategy to predict academic achievement scores need to be empirically tested in the educational psychology research.

Previously, Zimmerman and Schunk, (2008) emphasized that self-regulated learning strategy is a learning process in which self-regulated thoughts, feelings, and actions are systematically orientated towards attainment of the students' own goal orientations. In the view of Mischel and Ayduk (2004) self-regulated learning strategy is a construct that includes a monitoring and action component that encompass a complex array of interacting cognitive and emotional processes aimed at goal attainment. Reflecting on the study of Zimmerman (1986) this construct can be referred to as the degree to which individuals become meta-cognitively, motivationally and behaviourally active participants in their own learning processes.

Suffice it to say that self-regulated learning strategy being one of the cognitive skills could relate to academic achievement, but clearly not synonymous with cognitive competency. This is in consonant with the study of Schunk (2001) which defined self-regulated learning as learning that results from students' self-generated thoughts and behaviours that are systematically orientated toward the attainment of their learning goals. To become self-regulated learners, Boekaerts (1999) argued that students should learn to regulate the use of information-processing modes, the learning process and the self-beliefs.

Pintrich (2000) noted that self-regulated learning strategy involves activating and sustaining cognitions, behaviours and emotions in a systematic way to attain learning goals. Studies revealed that self-regulated learners are assumed to manage their behaviours and anxietiesso as to facilitate learning and actively avoid behaviours and cognitions that are detrimental to academic success (Stallwork-Clark, Cochran, Nolen, Tuggle, & Scott, 2000). Also, Zimmerman and Schunk, (2008) noted that self-regulated students understand the strategies and environments that are necessary for learning to occur and feel capable of performing on their personal

standards. For example, Schunk and Zimmerman (1994) opined that when challenged, self-regulated learners manage to understand when and how to utilize strategies that increase persistence and performance. They purposefully use meta-cognitive strategies that incorporate self-monitoring and evaluative components that allow for self-observation and self-reaction. Bandura (1986) noted that self-regulation has at least four components; such as self-observation, goal setting, self-judgement and self-reaction. These are metacognitive strategies that are integral parts of learning strategies that are being refer to the controlling and self-regulating aspects of metacognition. These strategies can be defined as useful skills for effective learning, for storage and retrieval of information.

In the present study, the clusters of self-regulated learning strategy such as; planning, monitoring, organization, rehearsal and regulated activity will be examined as the predictors of academic achievement. In the planning aspect, it represents the goal setting and task analysis. The monitoring aspect of this construct is referred to as regulating one's attention while reading, self-testing or questioning, helping the students to gain understanding and comprehension. The organization aspect of this is used to select information and build association between the aspects that need to be learned. The aspect of elaboration deals with storage of information in the long-term memory, creating connections between the aspects needed to be learned and also help to integrate new information with the knowledge which the student already has. The aspect of rehearsal deals with using basic memory activities, for example reciting or naming items to be learned. Then, regulating activity which refer to adjusting the cognitive resources in order to fulfil the task help to improve performance by checking and correcting one's own performance while engaging in a learning task. In response to these explanations, the researcher operationally defined self-regulated learning strategy as important cognitive construct that involves personally directed forms of learning, such as discovery learning, self-selected reading, or seeking information from electronic sources that will enhance positive learning outcome. This is an indication that these constructs such as self-directed learning and self-regulated learning strategy could have a link with students' academic self-concept to predict their academic achievement.

The believe that self-directed learning and self-regulated learning strategy are assumed to have important impact on student's self-beliefs to predict their academic achievement should be considered a major rationale of the present study. Despite the empirical support that self-directed learning and self-regulated learning strategy could relatively academic achievement, researcher findings are still unclear on how the constructs could influence students' academic self-concept to predict academic achievement. Globally, Rosenberg (1979, p.7) colloquially defined the composite view of self-concept as the totality of the individual's thoughts, feelings and having reference to oneself as an object. This definition has formed the theoretical

foundation of contemporary self-concept research that paved way for the emergence of academic self-concept. It shows that self-concept is organized, multifaceted, hierarchical, stable, developmental, evaluative and differentiable in nature.

It is on this view that Valentine, Dubois and Croper (2014) described academic self-concept as students' self-perception of their academic ability formed through individual experiences and interactions within the school environment. Importantly, academic self-concept is formed and developed through interactions with students' significant others such as parents, teachers and peers. It is dynamic as a student progress through schooling. Interesting to say that the overriding theoretical orientation of human perception is grounded in the perceptual psychology tradition. For example, Obilor (2011) noted that perceptual psychologists had postulated that all persons create their own reality through their perceptions of what they belief to be real. This indicates that a person's behaviour is contingent on how an individual perceives and interprets his/her experiences. Thus, from the perspective of the perceptual psychology, it is clear that to understand an individual's behaviour, we need to know how that individual perceives and interprets his/her experiences. In relation with the theoretical interpretation, Shavelson, Hubner and Stanton (2006) as was cited by Anyanwu and Emesi (2019) described academic self-concept as the totality of the cognitive beliefs that people have developed about themselves, which may represent everything that is known about their academic self. This is to say that it is the mental representation of one's academic ability that forms the internal beliefs system which one has for one's academic ability.

Rayner and Devis (2018) identified some key antecedents that determined the formation of academic self-concept such as; frames of reference, causal attribution, reflected appraisals from significant others, mastery experiences and psychological centrality. Frames of reference deals with the standards against which to judge one's own traits and accomplishments. Causal attribution is the factor to which people attribute their successes and failures that are hypothesized to influence descriptive and affective aspect of their academic self-beliefs. Reflective appraisals from significant others describes the view people have as they imagine how others view them, i.e., the make-up of reflected appraisals from the significant others. Mastery experience described how self-schemas are created from individual's past experiences in a particular domain. Rayner and Devis also noted that psychological centrality claims that self-concept is based on self-assessments of qualities that perceived as important or psychologically central by individuals.

In other words, to appreciate students' academic achievement, researchers need to understand how students perceive and interpret school and school subjects by investigating their academic belief systems such as academic self-concept, self-directed learning and self-regulated learning strategy. Then, the significant roles of education in examining the perceptual ability of the

students to engage in academic context will facilitate the development of the students' academic self-concept as adaptive academic beliefs that could predict academic achievement. In response to the above explanations, the scholars defined academic self-concept as an internal personality construct that represents the beliefs and dispositions for one's academic ability to achieve academically.

Interestingly, students' academic achievement is a fundamental priority and concern of all countries. Academic success of students enriches the human resources of the society and guarantees the future development of a country. In contrast, educational failures make communities impossible to use the potentials of human capital and endanger the sustainable development in addition to great monetary losses (Bahrami&Bahrami, 2015). This is because, preparing of individuals to acquire knowledge, skill and training of man power is the main task of education system. Importantly, positive self-concept and quality of educational system is among the most influential factors of national development and this could be traceable from the academic achievement of the students. The study of Adeyinka, Adedeji and Olufemi (2011) had described academic achievement as the attainment of success of a student in his school work among his classmates. Kpolovie, Joe and Okoto (2014) viewed academic achievement as the ability of the students to study and remember facts and being able to communicate their knowledge orally or in written form even in an examination condition. This shows that academic achievement is a measurable index that depicts a student's cognitive, affective and creative ability in an educational setting. In addition to that, academic achievement is the observed and measured aspects of a student's mastery of skills and subject contents as measured with valued and reliable tests (Joe, Kpolovie, Osonwa&Werima, 2014). In addition to the above definition, the researchers operationally defined academic achievement as the overall measure of students' cognitive, social, emotional and creative outcomes that represent an indication of success or failure in the academic context irrespective of subject domain.

Interestingly, many studies have examined the relationships that exist among these variables of the study. For example, the study of Anyanwu and Emesi (2021) revealed very low negative relationship between students' academic self-concept and their academic achievement in English language. The study of Obi, Onyegirim, Ani andEbe (2017) recorded low negative relationship between students' academic self-concept and their academic achievement in English language. Their study also indicated that there was a significant relationship between students' self-concept and their academic achievement. Sayid (2011) indicated that students' academic self-concept powerfully and positively predicted their general academic performance in literature and mathematics. The study of Obilor (2011) indicated that there is a significant positive relationship between

students' mathematics self-concept and their academic achievement in mathematics. The study of Emesi, Anyanwu and Ezenwosu (2022) recorded that students' self-regulated learning strategy predicted academic achievement in English language.in their findings, the seven assumptions that were statistically fit to predict the regression model. Relatively in their study, planning as a component of self-regulated learning strategy recorded a negative contribution but significant in predicting academic achievement. While the monitoring and regulating activity relatively contributed positively and significant in predicting academic achievement.

A general weakness of previous studies revealed in the current study is that they focused on the unique relations and predictions of academic self-concept, self-directed learning, and self-regulated learning strategy on students' academic achievement and failed to take into account the jointly contribution of the multifaceted nature of self-directed learning and self-regulated learning strategy in conjunction with academic self-conception predicting students' academic achievement. The revealed studies did not recognize the composite contribution of these constructs as salient indicators that could influence and impact relevant cognitive outcomes in the academic contexts. Therefore, the paucity of studies on how students' self-directed learning, self-regulated learning strategy and self-concept could jointly predict academic achievement in mathematics in Anambra State created a pathway for the present study. It is on this back drop that the researchers had considered the need to examine secondary school students' self-directed learning, self-regulated learning strategy and self-concept as predictors of academic achievement in mathematics in Anambra State, Nigeria.

Statement of the Problem

Self-directed learning, self-regulated learning strategy, and academic self-concept are crucial personality constructs that could enhance students' academic achievement if properly utilized at the secondary school level in Nigeria. The inappropriate usage and the inability to understand the significant roles of these constructs in the learning process by the students have not been examined by the researchers in the field of educational psychology thereby making it difficult for students recognize the essential contributions of the non-cognitive variables in the learning task. This problem has attracted the attention of the current study by the researchers to show concern on how the psychological beliefs system could assist students in coping effectively with academic tasks that range from managing tension, anxiety, fright/phobia in the learning situation that involves critical thinking and calculation, specifically mathematics subject.

The failure of the previous studies to identify the rationale behind the students' abysmal achievement in their mathematics scores, apparently created an insight to consider self-directed learning, self-regulated learning strategy, and academic self-concept as constructs that could facilitate students' mathematics achievement if properly

utilized. This is because, students' insensitivity in adopting the three psychological constructs in the learning situation may have resulted to their constant poor achievement in mathematics.

Research Questions

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

1. To what extent are the assumptions of multiple regression equation for predicting students' mathematics achievement scores using self-directed learning, self-regulated learning strategy and academic self-concept scores met?
2. What is the nature of the regression equation for predicting students' mathematics achievement scores using self-directed learning, self-regulated learning strategy and academic self-concept scores?
3. What are the unique contributions self-directed learning, self-regulated learning strategy and academic self-concept scores to predict students' academic achievement scores in mathematics?
4. Which of the independent variables predicts students' academic achievement scores in mathematics?

Hypotheses

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

1. The regression equation does not significantly predict students' mathematics achievement scores using self-directed learning, self-regulated learning strategy and academic self-concept scores.
2. The unique contributions of self-directed learning, self-regulated learning strategy and academic self-concept scores to predict students' academic achievement scores in mathematics is not significant.
3. Self-directed learning, self-regulated learning strategy and academic self-concept scores do not significantly predict students' academic achievement scores in mathematics.

Research Method

The researchers adopted a predictive correlational design and used questionnaires to collect data for the study. The population of this study consisted of 21204 which represented all the senior secondary school students II in Anambra State. A sample of 660 SS2 students was drawn from the senior secondary schools in the six education zones in Anambra State. Multi-stage sampling procedure was used to select the respondents. The procedures for the selection were as follows: In stage one, three education zones were selected from the six education zones in the state by simple random sampling. Then in stage two, from each sampled education zone, one local government area (L.G.A) was selected through simple random sampling given a total of three (3) L.G.As. In stage three, from each sampled L.G.A, 10 schools were randomly selected giving a total of 30 schools. Then, from each of the schools, 22 SSII students were selected for the study

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using a table of simple random sampling. This gave a total number of 660 students used in the study.

The study adapted three standardized research questionnaires namely, Marsh (1990) Self-Description Questionnaire (SDQ), Motivated Strategies for Learning Questionnaire (MSLQ, Pintrich, Smith, Garcia, &Mckeachie, 1996), and Shen and Hu (2011) Self-directed Rating Scale (SRS). The Students' Achievement Scores in Mathematics (SASM) were obtained from the schools before the start of the administration of the other two instruments. This represents students' achievement scores in mathematics from the state wide senior secondary one (SS1) promotion examination.

The methods used for validating the instruments were face and construct validity by the three experts from the Faculty of Education, NnamdiAzikiwe University Awka. Cronbach's alpha reliability method was used to determine the internal consistency of the items in the research questions such as: 0.87, for academic self-concept; 0.76, for elaboration; 0.67, for organization; 0.70, rehearsal; 073, for monitoring; 0.81, for planning, 0.72, for self-regulation; 0.74, for self-awareness; 0.84, for learning activity; 0.87, for interpersonal skills and 0.68, for self-evaluation respectively. The data were analyzed using standard multiple regression analyses. The t-test for r, F-test and test of significance for β, were used to test hypotheses at .05 level of significance.

Presentation of Results

The data were first screened for missing values, and 40 respondents had missing values representing 6.06%. Hence likewise deletion approach was adopted. After deleting the 40 respondents, the sample size was reduced to 620. Thereafter, analysis of the study was carried out using standard multiple regression analysis with PSS 26.

Research question 1: To what extent are the assumptions of the regression equation for predicting students' academic achievement in mathematics using self-directed learning, self-regulated learning strategy and academic self-concept scores met?

Table 1: Correlation and descriptive statistics of independent and dependent variables in the regression model for this study (N = 620).

Variables	SE	SA	LA	IS	EL	OG	RE	MO	PL	RA	ASC	Ach	X	SD	VAR	SK	KU	TF VIF
SE	1	21.74	4.354	18.957	-.357	-.179	.817	1.223										
SA	.288	118.04	4.819	23.222	-.495	-.199	.840	1.190										
LA	.207	.245	117.83	4.640	21.526	-.499	-.116	.875	1.143									
IS	.228	.214	.255	118.11	4.299	18.482	-.550	-.334	.866	1.155								
EL	.038	.060	.087	.131	119.70	2.932	8.599	-.118	-.517	.927	1.078							
OG	.045	.070	.058	.056	.118	120.10	2.896	8.397	-.196	-.406	.965	1.036						
RE		.105	.119	.076	.101	.170	.067	1	18.62	4.029	16.233	-.672	.125	.912	1.097			
MO	.166	.101	.082	.074	.096	.081	.225	118.42	4.225	17.853	-.719	.312	.895	1.117				
PL	.211	.159	.140	.135	.087	.087	.122	.184	117.94	4.446	19.768	-.616	.214	.885	1.130			
RA	.293	.247	.147	.177	-.054	.115	.083	.171	.242	117.94	4.821	23.246	-.422	-.195	.824	1.213		

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ASC.066	.025	.079	.092	.036.013	.047	.079	.032	.059	1	57.69	8.372	70.093	.134	-.640	.981 1.019
Ach -.237	-.142	-.116-..110-.061		-.056 -.094	.-.074	-.005	-.154-.042		1	53.079.009	81.154.529		-.354	……..	

Std. Residual Min = -2.005, Std. residual Max = 3.775, Durbin Waston statistics = 1.677. SE = Self-Evaluation, SA = Self-Awareness, LA = Learning Activity, IS = Interpersonal Skills, EL = Elaboration, OG = Organization, RE = Rehearsal, MO = Monitoring, PL = Planning, RA = Regulating Activity, ASC = Self-Concept and Ach = Academic Achievement.

Fig 1 the normal P.P plot of standardized residuals data points of academic achievement.

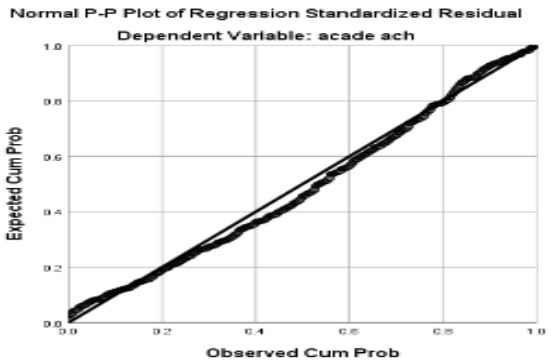


Fig 2 the normal distribution curve of standardized residuals data points of academic achievement.

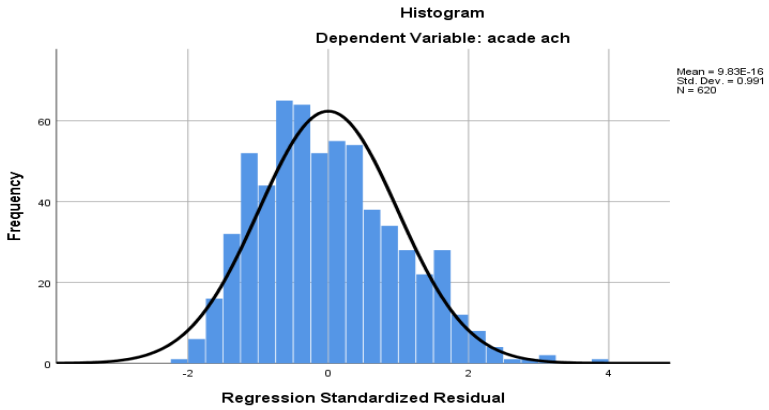
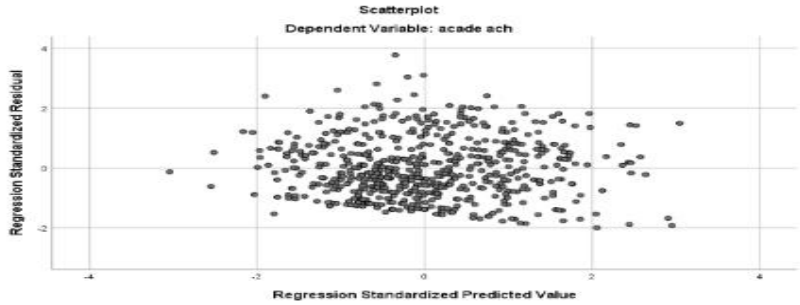


Fig 3 the scatter plot of standardized residuals data points of academic achievement.

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To answer research question 1, seven assumptions of multiple linear regression were tested in this study. First, the assumptions of normality of the data were tested using Skewness and Kurtosis. The assumptions were made since none of the Skewness and Kurtosis values of each of the variables do not exceed + 3 and – 3 as recommended. Second, the assumptions of absence of multivariate outliers were checked using standardized residual statistics and Cook's distance statistics (1977). Result of standardized residual values indicated that the (Std, Residual Min = -2.005, Std, Residual Max = 3.775). It lies between -3 to 3 as recommended by (Tabachnick and Fidell, 2018). While the result of the Cook's distance shows a maximum value of .024 which is less than 1 as recommended by (Cook, 1977). Hence, the assumptions of absence of multivariate outliers were not violated. Third, the assumptions of absence of multicollinearity among the predicting variables were checked using Variance Inflated Factor (VIF), and Tolerance Factor (TF). The Tolerance Factors and Variance Inflated Factors (Self-evaluation, TF = .817, VIF = 1.223; Self-awareness, TF = .840, VIF = 1.190; Learning activity, TF = .875, VIF = 1.143; Interpersonal Skill, TF = .866, VIF = 1.155; Elaboration, TF = .927, VIF = 1.078; Organization, = TF = .965, VIF = 1.036; Rehearsal, TF = .912, VIF = 1.097; Monitoring, TF = .895, VIF = 1.117; Planning, TF = .885, VIF = 1.130; Regulating activity, TF = .824, VIF = 1.213; Academic self-concept, TF = .981, VIF = 1.019 of the independent variables show that the values were less than 10 for Variance Inflated Factor and greater than .20 for Tolerance Factor respectively as recommended by (Schumaker, 2015). Hence, this assumption of absence of multicollinearity was made. Forth, the assumption of independent of error was tested using Durbin Waston statistics. The result shown a Durbin Waston statistic of 1.951 which is less than 3 but greater than 0 as recommended by (Denis, 2020). Hence, the assumption of independent of error was not violated. Fifth, the assumptions of normality of error distribution were tested using normal P.P plot of standardized residual. Figure 1shows that the normal P.P plot of standardized residual data points were normally distributed. Histogram of the standardized residual in figure 2 also testified to that. Sixth, the assumption of homogeneity of variance and linearity was tested using scatter plot of standardized predicted values. The result in figure 3 shows that the data met

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the assumption of homogeneity of variance and linearity as the predicted values were distributed above zero in both dimensions and do not show any pattern. Seventh, the assumptions of non-zero variance were tested using variance statistics and the data also met the assumptions of non-zero variances (Self-evaluation, Variance = 18.957; Self-awareness, Variance = 23.222; Learning activity, Variance = 21.526; Interpersonal skill, Variance = 18.482; Elaboration, Variance = 8.599; Organization, Variance = 8.397; Rehearsal, Variance = 16.233; Monitoring, Variance = 17.853; Planning, Variance = 19.768; Regulating activity, Variance = 23.246; Academic self-concept, Variance = 70.093; Academic achievement, Variance = 81.154) as there is no zero variance for the variables in the study as shown in the table 1.

Research Question 2: What is the nature of the regression equation for predicting students' mathematics achievement scores using self-directed learning, self-regulated learning strategy and academic self-concept scores?

Table 2: Regression coefficient for self-directed learning, self-regulated learning strategy and academic self-concept scores (N = 620).

Model	Unstandardized Beta	Std. Error	Standardized Beta
Constant	73.440	4.449	
Self-evaluation	-.390	.089	-.188
Self-awareness	-.095	.079	-.051
Learning activity	-.089	.081	-.046
Interpersonal skill	-.056	.087	-.027
Elaboration	-.129	.124	-.042
Organization	-.085	.123	-.027
Rehearsal	-.118	.091	-.053
Monitoring	-.030	.087	-.014
Planning	.182	.084	.090
Regulating activity	-.164	.080	-.088
Academic self-concept	-.016	.042	-.014

Using the information in table 2, the nature of the regression equation for predicting students' academic achievement in mathematics using self-directed learning, self-regulated learning strategy and academic self-concept scores follows:

$$Y = b0 + b1x1 + b2 \times 2 + b3 \times 3 + b4 \times 4 + b5 \times 5 + b6 \times 6 + b7 \times 7 + b8 \times 8 + b9 \times 9 + b10 \times 10 + b11 \times 11$$

$$Y = 73.440 + -.390 \times 1 + -.095 \times 2 + -.089 \times 3 + -.056 \times 4 + -.129 \times 5 + -.085 \times 6 + -.118 \times 7 + -.030 \times 8 + .182 \times 9 + -.164 \times 10 + -.016 \times 11$$

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Ach = 73.440 – 0.39 – 0.19 – 0.267 – 0.224 – 0.645 – 0.51 – 0.826 – 0.24 + 1.638 – 1.64 – 0.176

Achievement = 73.440 – 0.39SE – 0.19SA – 0.267LA – 0.224IS – 0.645EL - 0.51OG – 0.826RH – 0.24MO + 1.63PL – 1.64RA – 0.176 ASC

SE = Self-Evaluation, SA = Self-Awareness, LA = Learning Activity, IS = Interpersonal Skill, EL = Elaboration, OG = Organization, RH = Rehearsal, MO = Monitoring, PL = Planning, RA = Regulating Activity, ASC =Academic Self-Concept. The equation shows that for every unit decrease in self-evaluation, achievement decreased by -0.39. For every unit decrease in self-awareness, achievement decreased by -.019. For every unit decrease in learning activity, achievement decreased by - 0.267. For every unit decrease in interpersonal skill, achievement decreased by – 0.224. For every unit decrease in elaboration, achievement decreased by – 0.645. For every unit decrease in organization, achievement decreased by - 0.51. For every unit decrease in rehearsal, achievement decreased by - 0.826. For every unit decrease in monitoring, achievement decreased by - 0.24. For every unit increase in planning, achievement increased by 1.63. For every unit decrease in regulating activity, achievement decreased by 1.64. For every unit decrease in academic self-concept, achievement decreased by – 0.176.

Research Question 3: What is the unique contributions of self-directed learning, self-regulated learning strategy and academic self-concept scores to predict students' academic achievement scores in mathematics?

Table 3: Regression model summary of self-directed learning, self-regulated learning activity and academic self-concept scores to predict students' academic achievement scores in mathematics (N = 620).

Model	R	R-Square	Adjusted R- Square	Std. Error of the Estimate
	.290[a]	.084	.067	8.700

To answer this research, question the adjusted multiple regression R square was used. The result of study shows that using self-directed learning self-regulated learning strategy and academic self-concept scores yielded an adjusted R squared of .084. This implies that predictors accounted for about 8.4% of the variance scores in mathematics academic achievement.

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

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Table 4: Regression coefficient for students' academic achievement scores in mathematics using self-directed learning, self-regulated learning activity and academic self-concept scores (N = 620).

Model	Unstandardized Beta	Std. Error	Standardized Beta
Constant	73.440	4.449	
Self-evaluation	-.390	.089	-.188
Self-awareness	-.095	.079	-.051
Learning activity	-.089	.081	-.046
Interpersonal skill	-.056	.087	-.027
Elaboration	-.129	.124	-.042
Organization	-.085	.123	-.027
Rehearsal	-.118	.091	-.053
Monitoring	-.030	.087	-.014
Planning	.182	.084	.090
Regulating activity	-.164	.080	-.088
Academic self-concept	-.016	.042	-.014

Table 4: Regression coefficient for students' academic achievement scores in mathematics using self-directed learning, self-regulated learning strategy and academic self-concept scores. To answer this research question 4, the standardized regression coefficient (B) in table 4 was used for comparison. The regression coefficients presented in table 4 shows unstandardized (B) and standardized regression coefficient (B)self-evaluation scores are -.390 and -.188. For self-awareness scores are -.095 and -.051. For learning activity scores are -.089 and .087. For interpersonal skills scores are -.056 and -.027. For elaboration scores are -.129 and -.042.For organization scores are -.085 and -.027. For rehearsal scores are -.118 and -.014. For monitoring scores are -.030and -.014. For planning scores are .182 and.090.For regulating activity scores are -.164 and -.088. For academic self-concept scores are -.016 and -.014 respectively. Using the standardized beta for comparison, planning mostly predicted students' academic achievement in mathematics as shown by the B of .090. Self-evaluation is the second most predicted students' academic achievement in mathematics as shown by the B of -.188. Regulating activity is the third most predicted students' academic achievement in mathematics as shown by the B of -.088. Rehearsal is the fourth most predicted students' academic achievement in mathematics as shown by the B of -.053. Self-awareness is the fifth most predicted students' academic achievement in mathematics as shown by the B of -.051. Learning activity is the sixth most predicted students' academic achievement in mathematics as shown by the B of -.046. Elaboration is the seventh most predicted students' academic achievement in mathematics as shown by the B of -.042. Interpersonal skills and organization are the

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eight most predicted students' academic achievement in mathematics as shown by the B of -.027 respectively. While monitoring and self-concept are the ninth most predicted students' academic achievement in mathematics as shown by the B of -.014 respectively.

Hypothesis 1: The regression model does not significantly predict academic achievement scores in mathematics.

Table 5: F- test for regression model of self-directed learning, self-regulated learning strategy and academic self-concept scores on students' academic achievement in mathematics scores (N = 620).

Model	Sum of Squares	Df	Mean Square	F	Sig.
Regression	4217.738	11	383.431	5.066	.000[b]
Residual	46016.551	608	75.685		
Total	50234.289	619			

The analysis of variance in the table shows that the regression equation was significant (11, 608) = 5.066, $p < .05$. This implies that at least one of the independent variables significantly predicted the academic achievement in mathematics.

Hypothesis 2: The unique contributions of self-directed learning, self-regulated learning strategy and academic self-concept scores to predict students' academic achievement scores in mathematics?

Table 6. t-test of adjusted R square of the regression model for this study.

Model	R	R- Square	Adjusted R- Square	Std. Error Estimate	t – cal for adj. R^2	DF	t- crt.	Remark
	.290[a]	.084	.067	8.700	195.655	618	1.960	S

To test hypothesis 2, t-test for adjusted R square was conducted. Results of the study shown in table 6 indicates that t-critical for adjusted R square is 1.960 while that of the t-calculated is 195.655. Since the t-calculated for adjusted R square 195.655 is greater than t-critical 1.960, the null hypothesis which states that the unique contributions of self-directed learning, self-regulated learning strategy and academic self-concept scores to predict students' academic achievement scores to predict academic achievement in

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mathematics scores is not statistically significant is rejected and the alternative hypothesis is accepted. In other words, theunique contributions of self-directed learning, self-regulated learning strategy and academic self-concept scores to predict students' academic achievement scores is statistically significant. Effect sizes were also evaluated using adjusted R^2 comparing it with Cohen's *d* statistics guideline, where d < 0.20 indicates a minimal effects size, 0.20 < d < 0.50 indicates a small effect size, 0.50 < d < 0.80 indicates a moderate effect size and d > 0.80 indicates a large effect size. The value of R adjusted square .067 indicates a moderate effect size.

Hypothesis 3: Self-directed learning, self-regulated learning strategy and academic self-concept scores does not significantly predict students' academic achievement in mathematics.

Table 7: t-test of regression coefficient of students' academic achievement scores in mathematics self-directed learning, self-regulated learning strategy and academic self-concept scores

Model	Unstandardized Beta	Std. Error	Standardized B	T	P-value	Remark
Constant	73.440	4.449		16.507	.000	S
Self-evaluation	-.390	.089	-.188	-4.389	.000	S
Self-awareness	-.095	.079	-.051	-1.203	.229	NS
Learning activity	-.089	.081	-.046	-1.108	.268	NS
Interpersonal skill	-.056	.087	-.027	-.640	.522	NS
Elaboration	-.129	.124	-.042	-1.044	.297	NS
Organization	-.085	.123	-.027	-.692	.489	NS
Rehearsal	-.118	.091	-.053	-1.298	.195	NS
Monitoring	-.030	.087	-.014	-.340	.734	NS
Planning	.182	.084	.090	2.182	.029	S
Regulating activity	-.164	.080	-.088	-2.053	.040	S
Academic self-concept	-.016	.042	-.014	-.369	.713	NS

Table 7 shows that self-evaluation, planning and regulating activity scores significantly predicted academic achievement scores in mathematics since their p-values are smaller than .05. While self-awareness, interpersonal skills, elaboration, organization, rehearsal, monitoring and academic self-concept scores does not significantly predict academic achievement scores in mathematics since their p-values are greater than .05.

Discussion of findings

The findings from the study indicated that the seven assumptions that were tested did not violate the statistical guides being consulted in process of checking the assumptions. This is an indication that self-directed learning, self-regulated learning strategy and academic self-concept scores are potentially fit to examine students understand their motivational propensity to respond and

achieve academically. This supported the findings from the study of Anyanwu, Ezenwosu and Emesi (2022) which recorded that the seven assumptions that were tested in their study which involved self-regulated learning strategy were statistically fit for their study. Meeting the assumptions of the regression model implies that the data are suitable and amenable for the analysis. This implies that results obtained from the multiple regression analysis are more precise, accurate and reliable in predicting academic achievement scores in mathematics.

The findings from the result revealed that on the nature of regression equation, self-evaluation, self-awareness, learning activity, interpersonal skill, elaboration, organization, rehearsal, regulated activity and academic self-concept contributed negatively to the predicting model. While the planning has positive contribution to the predicting model. This implies that self-evaluation, self-awareness, learning activity, interpersonal skill, elaboration, organization, rehearsal, regulated activity and academic self-concept have low negative level of influence on students' academic achievement scores in mathematics. While planning has a low level of positive influence on students' academic achievement scores in mathematics. The findings partially supported the study of Anyanwu*et al* (2022) which recorded that planning has negative low contribution in predicting the regression model while monitoring and regulating activity have low positive contribution in predicting the regression model.

In the present study, the result revealed that using multiple regression R square stands to prove a dynamic joint prediction of academic achievement scores in mathematics using self-directed learning, self-regulated learning strategy and academic self-concept scores. The small percentage (8.4%) of these variables in predicting academic achievement scores indicated that the constructs are salient predictors of learning outcomes in mathematics. This supported the study of Anyanwu*et al* (2022) which revealed that clusters of self-regulated learning strategy and other variables jointly predict academic achievement with the small percentage of (0.2%).

Findings from the study also indicate that the independent variables have roles to play on students' academic achievement scores in mathematics. For example, when students' level of self-evaluation, self-awareness, learning activity, interpersonal skill, elaboration, organization, rehearsal, regulated activity and academic self-concept are negatively low, their level of willingness to confidently adjust and engage in learning of mathematics will be negatively low. Also, when students' level of planning is positively low, level of goal setting and task analysis in solving mathematics problems will positively be low. This partially supported the study of Anyanwu*et al* (2022) which revealed that when planning has negative low contribution in predicting the achievement scores in mathematics, the students' level of academic goal setting and analysis will be low. Then when students' level of monitoring and regulating activity have low positive

contribution in predicting their academic achievement scores in mathematics their level of confident to adjust and engage in learning of mathematics will be positively low.

Finding in the study using effect sizes to evaluate using adjusted R^2 tocompare it with Cohen's *d* statistics guideline, the value of R adjusted square .067 indicates a minimal effect. This shows that academic achievement is decreasing considering the motivational constructs being tested in the present study. It is an indication that there is students' motivational apathy to respond, adjust and engage in the learning task as well as achieving academically as the variables jointly predict mathematics achievement scores. This supported the finding from the study of Anyanwu*et al* (2022) which revealed that the value of R adjusted square .002 as it indicates a minimal effect.

Conclusion

The outcome of the present study unveiled that self-directed learning, self-regulated learning strategy and academic self-concept scores jointly predict students' academic achievement scores in mathematics.

Recommendations

Based on the findings, the following recommendations were made:

1. Students should properly utilize their self-directed learning, self-regulated learning strategy and academic self-concept since the level of percentage contribution of the variables in predicting academic achievement scores in mathematics is too poor. The poor percentage contribution is an indication that students do not use the constructs effectively in the process of learning.
2. Teachers should advice the students to make use of their self-directed learning, self-regulated learning strategy and academic self-concept in the learning process so that their level of confidence to predict academic achievement scores will be high.
3. It was it was recommended that parents should play a significant role by mentoring their children on the importance of self-directed learning, self-regulated learning strategy and academic self-concept in the everyday academic context since the three variables had jointly predicted academic achievement scores.
4. For the benefit of future studies, researchers should adopt other analytical approaches such as comparative correlation and hierarchical regression to examine the effects of these variables on students' academic achievement.

REFERENCES

Adeninka, T., Adedeji, T. &Olufemi (2011). Locus of control, interest in school and self-efficacy as predictors of academic achievement among junior secondary school students in Osun State, Nigeria. *New, Horizons in Education, 59*(1), 25-35.

Anyanwu, A. N &Emesi K. E. (2019). Relationship among secondary school students' academic self-concept, self-esteem and academic achievement in mathematics in Anambra State. *Unizik Journal of Educational Research and Policy Studies, 1* (1), 114-116.

Anyanwu, A.N., &Emesi, K.E. (2020). Secondary school students' self-esteem and achievement goal orientation as correlate of academic achievement in mathematics in Anambra state. *International Journal of Multidisciplinary and Current Educational Research, 2*(5) 218-226.

Anyanwu, A.N, &Ezenwosu, N.E. &Emesi, K.E. (2022). Goal orientation and self-regulated learning strategy as correlates of students' academic achievement in English language in Anambra State, Nigeria. *International Journal of Multidisciplinary Research and Analysis, 5*(11), 3150-3160. Doi: 10.47191/ijmra/v5-i11-23, Impact Factor: 6.261.

Anyanwu, A.N. &Emesi, K.E. (2021). Secondary school students' learning strategies and self- directed learning as correlates of critical thinking in Anambra State. *African Journal of Educational Management, Teaching and Entrepreneurship Studies, 3,* https://ajemates.org.

Baharami, D. &Baharami, M.A (2015). Correlation of self-esteem and achievement goals. The Case of Iranian students. *World Applied Science Journal, 33* (4), 557-563.

Bandura, A. (1986). *Social foundation of thought and action: A social; cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.

Berndt, T.J., & Keefe, K. (1992). Friends' influence on adolescents' perceptions of themselves at school. In D. Schunk& J. Meece (Eds.), *Student perceptions in the classroom* (pp.51-74). Hillsdale, NJ:Erlbaum.

Boekaerts, M. (1999). Self-regulated learning: Where we are today. *International Journal of Educational Research, 31* (6), 445-457.

Cohen, J. (1988). Statistical power analysis for the behavioral sciences. New York, NY: Routledge Academic.

Cook, R.D. (1977). Detection of influential observations in linear regression. Technometrics, American Statistical Association.

Denis, D.J. (2020). Univariate, Bivariate and Multivariate Statistics Using R: Quantitative Tools for Data Analysis and Data Science. India: Wiley Publication.

Emesi, K.E, Anyanwu, A.N, &Ezenwosu, N.E. (2022). Using achievement goal orientation and self-regulated learning strategy as predictors of academic achievement in English language among the secondary school students in Anambra State, Nigeria. *International Journal of Education and Evaluation, 8*(7) 50-64. Doi: 10.56201/ijee.v8.no7.2022.

Hiemstra, R. (1994). Self-directed adult learning. In Husen*et al* (Eds.). *International Encyclopedia of Education*. Peergamon Press, Oxford.

Joe, A.N., Kpolovie, P.J., Osonwa, K.E., &Werima, C.E. (2014). Modes of admission and academic achievement in Nigerian Universities. Retrieved *from http://meritresearcherjuornals.or/er/content/2014/Pkolovie%20et%20al.pdf.*

Knowles, M.S. (1975). *Self-directed learning: a guide for learners and teachers.* Follett Publishing, Chicago, II.

Kpolovie, P.J., Joe, A.N., &Okoto, T. (2014). Academic achievement prediction: Role of interest in learning and attitude towards school. *National Journal of Humanities, Social Science and Education, 11*(1), 73-100.

Marsh, H.W. (1990). Self-Description Questionnaire (SDQ) II: *A theoretical and empirical basis for the measurement of multiple dimensions of adolescent self-concept:* An interim test manual and a research monograph. San Antonio Texas: The psychological corporation.

Mischel, W. &Ayduk, O. (2004). Willpower in a cognitive-affective processing system. In R. E. Baumeister& K. D, Vohs (Eds.). *Handbook of self-regulation* (pp. 99-129). New York: Guilford Press.

Niepel, C. Brunner, M., &Preckel, F. (2014). Achievement goal, academic self-concept, and school grades in mathematics: longitudinal reciprocal relations in above average ability secondary school students. *Contemporary Educational Psychology, 39,* 301-313.

Obi, A., Onyegirim, B.O., Ani., D.N., &Ebe, K.N. (2017). Relationship between students' and self-concept, and their academic achievement in English language in Enugu State, Nigeria. *International Journal of Education, Development, Society and Technology, 5* (15), 151-158.

Obilor, I.E. (2011). Relationship between self-concept and mathematics achievement of senior secondary students in Port Harcourt metropolis. *Journal of Educational and Social Research, 1*(4), 39-44.

Pintrich, P. R, Smith, D.A.F., Garcia, T., &Mckeachie, W.J. (1996).*A manual for the use of motivated strategies for learning questionnaire (MSLQ).*Ann Arbor, Michigan: University of Michigan.

Pintrich, P.R. (2000). The role of goal orientation in self-regulated learning.in M. Boekaerts, P. R. Pintrich, & M. Zendner (Eds). Handbook *of self-regulation* (pp.415-502). San Diago CA: Academic.

Rayner, S.G., &Devis, U. (2018). Self-esteem and self-perceptions in the classroom: valuing circle time? In: Riding, R.J., and Rayner, S.G. (eds.). *International Perspective on Individual Differences, 2: Self Perception,* Ablex, Westport, CO. pp.171-208.

Rosenberg, M. (1979). Society and the adolescent self-image. Princeton, New Jersy: Princeton University Press.

Sayid, D.G. (2011). Relationships between academic self-concept and academic performance of high school students. *Social and Behavioural Sciences, 15,* 103-109.

Schumacher, R.E. (2015). Using R with multivariate statistics. A premier. London: Sage Publication.

Schunk, D.H. (2001). Social cognitive theory and self-regulated learning.In B.J. Zimmerman & D.H., Schunk (Eds.). *Self-regulated learning and academic achievement: Theoretical perspective,* (vol.2, pp. 125-152). Mahwah, NJ: Lawrence Erlbaum.

Schunk, D.H., & Zimmerman, B.J. (1994). Self-regulation of learning and performance: Issues and education applications. Hilledale, NJ: Lawrence Erlbaum.

Shavelson, R.J., Hubner, J., & Stanton, G.C. (2006). Self-concept: Validation of construct interpretations. *Review of Educational Research, 46,* 407-441.

Shen, W.Q., & Hu, Y. (2011). Reliability and validity of the Chinese version of the self-directed learning rating scale. *Chinese Journal of Nursing, 46*(12),1211-1213.

Stalwirth-Clark, R., Cochran, J., Nolen, M.T., Tuggle, D.L., & Scoff, J.S. (2000). Test anxiety and performance on reading competency test. *Research and Teaching in Developmental Education, 17,* 39-47.

Tabachnick, G.B., &Fidell, L.S. (2018). Using multivariate statistics. New York: Pearson.

Tabchnick, G.B., &Fidell, L.S. (2018). Using multivariate statistics. New York: Pearson.

Valentine, J.C., Dubois, D.L., Copper, H. (2014). The relations between self-beliefs and academic achievement: A systematic review. *Educational Psychology, 39,* 111-133.

Williamson, S.N. (2007). Development of a self-rating scale of self-directed learning. *Nurse Researcher, 14*(2), 66-83. Doi: 10.7748/nr2007.01.14.2.66.c6022.

Zimmerman, B.J., &Schunk, D.H. (2008). Motivation: An essential dimension of self-regulated learning. In D.H Schunk& and B.J. Zimmerman (Eds.). *Motivation and self- regulated learning: Theory, research, and application* (pp. 1-30). New York: Laurence Erlbaum.