Achievement Motivation And Emotional Intelligence As Predictors Of Mathematical Resilience Among Secondary School Students

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ABSTRACT

This study investigated achievement motivation and emotional intelligence as predictors of Mathematical resilience among senior secondary school students in Rivers Nigeria. Two research questions were answered and two hypotheses were tested at 0.05 alpha level. The population of the study comprised all 24,727 senior secondary school (SS2) students in the 247 public secondary schools in Rivers State. Sample size of 1690 was obtained using 20% of the population in simple random sampling technique. Three self-designed non-cognitive instruments titled Achievement Motivation Scale" (AMS), "Emotional Intelligence Scale" (EIS) and "Mathematical Resilience Scale" (MRS) were used for data collection. The AMS contained 14 items; EIS contained 17 items while MRS contained 20 items respectively. Face and content validities were carried out by the researchers along with three other experts in test, measurement and evaluation. The Cronbach reliability coefficient of 0.75, 0.72 and 0.77 were obtained for AMS, EIS and MRS respectively. Linear and multiple regressions were used to answer the research questions while t-test and ANOVA associated with linear and multiple regressions were used to test the null hypotheses. It was found among others that achievement motivation significantly predicted mathematical resilience. Emotional intelligence and achievement motivation jointly and significantly predicted mathematical resilience. It was recommended among others that guidance counselors should help students to reshape their minds from fixed to growth mindsets in order to become mathematical compliant as opposed to mathematical anxious.

Keywords: Achievement Motivation, Emotional Intelligence and Mathematical resilience

INTRODUCTION

Mathematics is a compulsory subject in secondary school curriculum in Nigeria because of its' wide application in all spheres of life and relevance in understanding the contents of many academic subjects. Devlin (2012) is of the view that mathematics is the language of science comprising of logical, analytic and quantitative reasoning critical for twenty first century living and effective participation in global economy. Students who find it difficult to master basic mathematics skills may end up struggling with other school subjects, have limited career choice or sweat to perform simple measurements, proportioning, market analysis and the likes. In spite of the numerous benefits of mathematics to students, many of them fear and abstain from mathematics classes. A study of situational influence of secondary school students in mathematics reported that many students find mathematics classes boring, meaningless, and un-involving (Mitchel, 1993). Many of these students fail mathematics because they believe that it is too difficult to master. The West African Examination Council records revealed

that an average of 61.67 percent of candidates that sat for mathematics in 2018 West African School Certificate Examination obtained D and F grades (Nwachukwu, 2018). This statistic is alarming considering the important role of mathematics in attaining much desired technological development in the country.

Ibrahim (2015) categorized the causes of mass failure in mathematics under two sub-headings: teachers' influence and students' mentality. Factors relating to teachers' influence include, poor teaching techniques, inability to make mathematics practicable and simple, and poor knowledge of the course. Moreover, students contribute to mass failure of mathematics due to apathy or hatred for the subject, lazy attitude to studying the subject, seeing the subject as abstract, and working in isolation. Jimoh (2017) blamed teachers for mass student failure in mathematics. Mathematics teachers according to her, pay greater emphasis on the use of lecture mode of instruction and textbooks rather than engaging students in critical thinking across subject areas and practical application of the mathematics in life problems. She also attributed mass failure to students' lack of frequent practices, inadequate grasp of mathematical language, poor mathematical background, and parent influence on child's career choice. Ugwu and Amadi (2012) identified poor student-teacher relationship as the main contributor to students' situational and personal interest in mathematics in a study of 276 senior secondary school students in five secondary schools in Port Harcourt metropolis, Nigeria. The researchers encouraged mathematics teachers to be free with their students and also encourage students to be free with mathematics teachers, emphasizing that this process would enhance higher intellectual functioning in mathematics.

The Federal Government of Nigeria (2004) made mathematics prerequisite for entering into Engineering, Science, Business and related courses in higher institutions and a compulsory course in West African school certificate because of its core importance in nations building. In the bid to give national exposure to this problem and help students pursue science, engineering, computer and commerce related courses, the National center for Mathematics and Federal Ministry of Education resolved to go back to basics to address the problem (Onah, 2018). Methods employed to improve students' poor performance in mathematics focused mainly on teaching competence, teaching methods and pedagogy, teaching aids, class size, student mathematical background, non-involvement of learners and parental influence. Studies on mathematical resilience, achievement motivation, emotional intelligence and their joint contributions in motivating interest and success in mathematics have not been given the desired attention by researchers and government agencies.

REVIEW OF RELATED LITERATURE

Learning mathematics can be very difficult for many students, obstacles encountered in learning the subject can lead to mathematical anxiety, phobia, unpleasant pressure, avoidance and low fixed mindset on the extent which the subject can be learned. Elliot & Dweck's (2005) fixed theory of learning posits that students have fixed belief on the extent they can learn a subject. Fixed mindset and other problem that impede mastering of mathematics can be overcome through mathematical resilience (Marshall, Staddon, Wilson & Mann, 2017). Johnson–Wilders & Lee (2010:2) defined mathematical resilience as "positive adaptation that allows learners overcome barriers that are frequently present when learning the subject or that quality by which some learners approach mathematics with confidence, persistence and wiliness to discuss, reflect and research". Simply put, mathematical resilience is development of confidence and willingness to learn mathematics amidst difficulties, and the courage to bounce back after failures (Williams, 2014). Kooken, Welsh, Mccoach, Johnston-Wilder, & Lee (2012) sees resilience in mathematics as positive response to challenges in studying mathematics characterized by persistence, good attitude, value and belief leading to better

performance and success in the subject. Review of literature by the researchers revealed that the study of resilience in academic setting and especially resilience in the study of mathematics represents a relatively new approach.

Lee & Johnson-Wilder (2016) maintain that mathematical resilience enables learners restructure their minds from fixed to growth mindsets and allow students to become mathematical thinkers as opposed to mathematical anxious. These can readily be achieved by comprehending the subject, developing personal values for mathematics, recognizing the importance of mathematics in everyday living, understanding that mathematics can be learned through hard work, and finding appropriate support to enhance performance. Teachers should help students develop resilience rather than creating mathematical anxiety by verbally abusing or sanctioning deficient students. Adekunle (2015) maintained that mathematical resilience helps students learn the subject willingly and happily. In addition, lost confidence in mathematics can be achieved by frantic efforts and right support in classrooms especially for students who are at risk of failure (Maxman, 2011).

Achievement motivation is a concept made up of two words: achievement and motivation. Achievement is the measure of the extent to which an individual has attained his or her set goals while motivation is the driving force or reasons that stimulate achievement. Achievement motivation is therefore the zeal to strive for higher performance, mastering of skills and satisfaction derived from achieving higher goals. Harter & Connell (1984:222) defined achievement motivation as the zeal to engage in achievement behaviours based on the interaction of parameters such as need for achievement, expectancy of success, and incentive value of success". Elliot and McGregor (2001) noted that achievement motivated individuals' strive to master and perform the task at hand, and also demonstrate superior performance relative to others. This concept according to Elliot and Dweck (2005) should be re-conceptualized as competence motivation since individuals who value competence will be motivated to strive for success. Achievement motivation in a given area can be attained by setting reasonably high goals, initiating actions towards accomplishment of such goals, engagement and determination to succeed despite obstacles (Singh, 2011).

Individuals have natural desire to achieve significant goals and attain high standards in their endavours but are often limited by ability and lack of motivation. Achievement motivation helps such people to persevere and achieve rather than shy away from their intrinsic desire to excel. Motivation to achieve higher goals could be self-directed or stem from the environment. Self-motivated learners are internally motivated, curious and happy to engage, expand and enhance learning. Most students who are motivated to achieve significant outcomes work hard for external rewards (Zenzen, 2002) but those who are intrinsically motivated to learn mathematics for example; engage in mathematics tasks mainly for the love of it. Achievement motivation that comes from the environment is often spurred by need for approval from important others such as parents, peers, teachers or external incentives; good grades.

Performance in a given event including learning of mathematics is the product of ability and motivation (Winzel, 2012). Ability matched with action no doubt is a better predictor of performance (Schmidt & Hunter, 1992); however, many students with low mathematical ability can be encouraged to succeed in the subject through achievement motivation to the point of resilience. Students with low level ability in mathematics can achieve above average performance if motivation is directed towards achievement of set goals and objectives; success begets success. Thus, lost confidence in mathematics can be resuscitated by frantic efforts and right support in classrooms especially for students who are at risk of failure (Adekunle, 2015; Rivera & Maxman, 2011). Various studies confirmed that achievement motivation for students

and teachers related positively with success in mathematics (Amaeze, 2017; Yaman, Dundar, Ayvaz, 2015; Awan, Noureen, Naz, 2011; Opurum, 2013) and mathematics resilience (Johnston-Wilder & Lee, 2010).

Emotions are complex states of mind and body, consisting of subjective physiological, behavioural, and cognitive reactions to situations (Rupande,2015) as distinguished from less cognitions; knowledge and reasoning. Emotional reaction of anxiety (mathematical anxiety) is associated with symptoms such as racing heart, sweaty palm, fear, negative attitude, lack of interest and avoidance that contribute to poor performance in examinations. Emotional intelligence; the effective control and use of emotions or ability to make one's emotions work for instead of against the individual (Bariso, 2017) can effectively be employed to ameliorate these negative emotions. Thus, emotional intelligence often consists of management of negative emotions that promote failure and promotion of positive emotions to enhance success. This multi-dimensional concept involve individuals' ability, capacity, or skills to perceive, assess, assimilate and manage one's emotions, those of others and of groups to achieve individual and group goals (Salovey& Mayer, 1990; Amaeze, 2017; Rupande, 2015). It also includes introduction of reasons into emotion and replacement of negative emotions generated by mathematics difficulties such as phobia with positive emotions of confidence acquired mainly through achievement motivation.

Beard (2012) summarized the components of emotional intelligence to include self-awareness, self-regulation, internal motivation, empathy and social skills. Self-awareness is seen as one's knowledge about the mood and emotional disposition. Self-regulation is likened to students' ability to initiate and control emotions and behaviours toward some impulses that will enable them meet some established standards, objectives, goals or self-expectation. A student with improved self-regulation is expected to adjust her negative emotions and at the same time maintain school standards without much conflict. Internal motivation is the drive that stems from the inside of the individual to achieve a set goal. Self empathy is one's strong feelings towards another person's predicament or the understanding and association with another person's problems and sorrows. Social skill is the required skills that enable individuals to interact and associate with each other. Kennedy-Moore (2011) saw social skills as the abilities necessary to get along with others and to create and maintain satisfying relationships. Nor, Ismail, Yusuf (2016) study on emotional intelligence in learning mathematics revealed a significant relationship between emotional intelligence and mathematics competence. Emotional intelligence is often linked with resilience (Schneider, Lyons, & Khazon, 2013) and regarded as antecedent to resilience).

STATEMENT OF THE PROBLEM

This study seeks to extend the existing researches that have been conducted on the effects of resilience on students' success in mathematics by incorporating emotional intelligence and achievement motivation that may combine to predict success in mathematics. The failure rate in mathematics at West African School Certificate Examination is very high compared to other subjects. The high failure is a serious concern to stakeholders considering the role of mathematics in achievement of much desired technological development and smooth functioning in this emerging economy. The mass failure has been attributed to many causes including students' anxiety towards mathematics which hinders learning of the subject and poor performance in examinations if not properly taught. Most methods employed to improve students' performance in the subject focus mainly on methods, teaching aids and the likes. The problem of mass failure in mathematics is so important to education stakeholders to the extent that Federal Ministry of Education and National Council of Mathematics have partnered to develop strategies to improve students' performance in the subject. However, they were not

particular about the numerous potentials of resilience and its predictors in overcoming mathematics phobia, other negative emotions and attitudes as well as motivating students' interest in mathematics. Unaddressed mathematics phobia may lead to wrong career choice, low production of quality graduates in science and technology, job dissatisfaction, low self-concept and self-efficacy. The researchers are concerned that poor academic performance in Mathematics is detrimental to students' desires to pursue science related careers and achievement of desired educational goals. Further, recent literature review revealed that study of resilience in academic settings especially in study of mathematics represents a new approach.

AIM AND OBJECTIVES

The aim of the study was to investigate the extent to which achievement motivation and emotional intelligence predict Mathematical resilience among senior secondary school two (SSS II) students in PortHarcourt Metropolis of Rivers State, Nigeria. Specifically, the study sought to:

1. Determine the extent to which achievement motivation predicts mathematical resilience among senior secondary school two (SSS II) students in PortHarcourt Metropolis of Rivers State, Nigeria.
2. Examine the extent to which emotional intelligence (self-regulation, self-awareness, empathy motivation and social skills) jointly and independently predict mathematical resilience among senior secondary school two (SSS II) students in PortHarcourt Metropolis of Rivers State, Nigeria.

RESEARCH QUESTIONS

The following research questions were answered:

1. To what extent does achievement motivation predict Mathematical resilience among senior secondary school two (SSS II) students in PortHarcourt Metropolis of Rivers State, Nigeria?
2. To what extent does emotional intelligence (self-regulation, self-awareness, empathy, motivation and social skills) jointly and independently predict mathematical resilience among senior secondary school two (SSS II) students in PortHarcourt Metropolis of Rivers State, Nigeria?

HYPOTHESES

The following null hypotheses were tested at 0.05 alpha level of significance.

1. Achievement motivation does not significantly predict mathematical resilience among senior secondary school two (SSS II) students in Port Harcourt Metropolis of Rivers State, Nigeria.
2. Emotional intelligence (self-regulation, self-awareness, empathy, motivation and social skills) do not significantly predict mathematical resilience among senior secondary school two (SSS II) students in Port Harcourt Metropolis of Rivers State, Nigeria.

METHODOLOGY

The study adopted a correlational research design. The population of the study comprised all the 24,727 senior secondary school two (SS II) students in secondary schools in PortHarcourt Metropolis (Rivers State Senior Secondary School Board, 2017). PortHarcourt Metropolis as used in this study spread across two local government areas namely, PortHarcourt City and Obio-Akpor Local Government Areas of Rivers State, Nigeria. The sample size of the study was 1690 senior secondary school two (SS II) students, using 20% of the population; the simple random sampling technique was used to draw the sample. The estimate of a minimum sample size of this study was determined using Krejcie and Morgan (1970) Formula thus: Sample = [x^2

NP (1-P)] ÷ [α2(N-1) + x^2 P (1-P)].The choice of the population in this study is appropriate for the reason that SS II students are about to enter the senior secondary school three (SS III), in which they have to obtain at least a credit in Mathematics as a basic requirement for furthering their study in any higher institution in Nigeria.

Three instruments structured by the researchers and titled Achievement Motivation Scale (AMS), Emotional Intelligence Scale (EIS) and Mathematical Resilience Scale (MRS) were used for data collection. The AMS contained 14 items; EIS had 17 items while MRS contained 20 items. Face and content validities were carried out by the researchers along with three other experts in Test and Measurement in the Department of Educational Psychology, Guidance and Counselling. The Cronbach reliability coefficient was used to establish the reliability coefficients of the instruments; AMS, EIS and MRS gave reliability coefficients of 0.75, 0.72 and 0.77 respectively. Simple and multiple regressions were used to answer the research questions while t-test and Analysis of Variance (ANOVA) associated with linear and multiple regressions were used to test the null hypotheses.

RESULTS

The results of this study are presented as shown below.

Research Question One: To what extent does achievement motivation predict mathematical resilience among senior secondary school two (SSS II) students in PortHarcourt Metropolis of Rivers State, Nigeria?

Table 1a: Simple regression on the extent achievement motivation predicts mathematical resilience

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.478[a]	.228	.223	10.33557

Table 1a shows that achievement motivation has a very low positive relationship of 0.478 with mathematical resilience. The coefficient of determinism of 22.8% shows the extent achievement motivation predicts mathematical resilience of senior secondary school two (SSS II) students in PortHarcourt Metropolis of Rivers State, Nigeria. The remaining 77.2% was accounted by other variables apart from achievement motivation.

Hypothesis One: Achievement motivation does not significantly predict mathematical resilience among senior secondary school two (SSS II) students in PortHarcourt Metropolis of Rivers State, Nigeria.

Table 1b: t-test associated with simple regression on the extent achievement motivation predicts mathematical resilience

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	53.839	4.708		11.436	.000
	Achievement motivation	-1.030	.319	-.397	-3.233	.002

Table 1b revealed that achievement motivation has a beta value, t-value and significant value of -.397, -3.233 and .002 which is significant at 0.05 alpha level of significance. Therefore the

null hypothesis is rejected. By implication, achievement motivation significantly predicts mathematical resilience among senior secondary school two (SSS II) students in PortHarcourt Metropolis of Rivers State, Nigeria.

Research Question Two: To what extent does emotional intelligence (self-regulation, self-awareness, empathy, motivation and social skills) jointly and independently predict mathematical resilience among senior secondary school two (SSS II) students in PortHarcourt Metropolis of Rivers State, Nigeria?

Hypothesis Two: Emotional intelligence (self-regulation, self-awareness, empathy, motivation and social skills) do not jointly and independently predict mathematical resilience among senior secondary school two (SSS II) students in PortHarcourt Metropolis of Rivers State, Nigeria.

Table 2a: Multiple regression and ANOVA associated with multiple regression on the joint prediction of emotional intelligence on mathematical resilience

R=.421						
R^2= .177						
Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	6189.113	5	1237.823	9.910	.000[a]
	Residual	54835.813	1685	124.911		
	Total	61024.927	1690			

Table 2a was used to answer research question two and test hypothesis two. Result obtained revealed regression square coefficient of 0.177. Therefore, emotional intelligence predicts mathematical resilience by 17.7%. It was shown that the mean square for regression and residual variables are 6189.113 and 1237.823 respectively. With degrees of freedom of 5, and 1685, the F calculated value is 9.910. F, (9.910), df (5,1685), p>0.000. The ANOVA associated with multiple regression showed that p value is greater than the significant value of 0.000. By implication, the null hypothesis is rejected. Therefore, there is a significant joint prediction of emotional intelligence (self-regulation, self-awareness, empathy, motivation and social skills) on mathematical resilience among senior secondary school two (SSS II) students in PortHarcourt Metropolis of Rivers State, Nigeria.

Table 2b: Beta value on the independent prediction of emotional intelligence on mathematical resilience

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	T	Sig.
1	(Constant)	27.449	2.092		5.891	.000
	Self-regulation	.301	.071	.338	2.224	.000
	Self-awareness	.211	.045	.214	1.368	.002
	Empathy	.003	.012	.007	.435	.022
	Motivation	.036	.032	.101	.545	.059
	Socialskills	.032	.033	.200	1.044	.010

Table 2b showed that the components of emotional intelligence (self-regulation, self-awareness, empathy, motivation and social skills) with t-values of 2.224, 1.368, .435, .545 and 1.044 are all significant at 0.000, 0.002, 0.022, 0.059 and 0.010 when subjected at an alpha level of 0.05. Therefore, emotional intelligence (self-regulation, self-awareness, empathy, motivation and social skills) independently is a significant predictor of mathematical resilience among senior secondary school two (SSS II) students in PortHarcourt Metropolis of Rivers State, Nigeria.

DISCUSSION OF FINDINGS
Achievement Motivation and Mathematical Resilience

Achievement motivation is a predicts a significant predictior of mathematical resilience among senior secondary school two (SSS II) students in PortHarcourt Metropolis of Rivers State, Nigeria. The finding of the study is not surprising to the researchers; achievement motivation, the need to attain excellence in mathematics can readily improve mathematical resilience of students. This finding is in tandem with the report of Amaeze (2017) who found a significant prediction of achievement motivation on enhanced achievement among secondary school students. Students who are motivated to succed in mathematics are very likely to succed and also bounce back if they fail. The failure to solve a mathematical may even be a source of motivation. The finding supports Elliot and Dweck (2005) assertion that individuals who are motivated to strive to master and perform a task at hand would demonstrate greater resilience and performance, see also Kooken, et al., (2012).

Mathematics teachers, parents and other stakeholders are advised to motivate students to believe they have potentials to succeed in mathematics. They should also be rewarded whenever they do well in mathematics. Other motivational techniques should be incorporated in teaching mathematics such as application of mathematical formula and other devices in solving real life problems.

Emotional intelligence and Mathematical Resilience

Results indicate that emotional intelligence predicted mathematical resilience among secondary school students in Rivers State, Nigeria. Further, all five constructs of emotional intelligence, (self-regulation, self-awareness, empathy, motivation and social skills) jointly and independently predicted mathematical resilience among senior secondary school two (SSS II) students in Port Harcourt metropolis, Rivers State, Nigeria. The finding depicts that emotional intelligence brings about mathematical resilience among secondary school students in Rivers State. Emotion regulation for example may be used to increase attention span of students in mathematics classrooms. Students should be encouraged to relax and be less anxious while solving mathematical problems. This result supports Johnston-Wilder and Lee (2010) assertion that emotional intelligence relates to resilience in performance of a given task. Students should also be taught on how to use their negative emotions to focus on attaining a goal in mathematics rather than give up. Opurum (2013) study also revealed that development of high emotional intelligence enable students to withstand various characteristics of teachers and also improve teaching and learning. Teachers and parents should be concerned about managing students emotions about mathematics as a vital tool for success.

CONCLUSION

Based on the findings of this study, it was concluded that achievement motivation and emotional intelligence substantially predicted mathematical resilience among senior secondary school two (SSS II) students in PortHarcourt Metropolis of Rivers State, Nigeria. Students should be motivated to struggle to learn mathematics irrespective of difficulties and failures encountered in mathematics. They should be helped to understand to believe that

mathematics problems and phobia are surmountable. This change of mindset coupled with good attitude, setting and attempting achievable goals, constant practice, and positive evidence from similar others who have succeeded in mastering the subject, together with other components of achievement motivation and emotional intelligence should spur resilience and eventual success in mathematics. Stakeholders determined to improve success rates of students in mathematics through mathematical resilience are encouraged to include achievement motivation and emotional intelligence in their quest.

RECOMMENDATIONS

Based on the findings of the study, the following recommendations were made.

1. School counsellors should help students to restructure their minds from fixed to growth mindset in order to become mathematical compliant as opposed to mathematical anxious.
2. School counsellors should organize workshops on the effectiveness of achievement motivation and intelligence mathematical resilience for teachers and students respectively.
3. School management should introduce Mathematics peer mentoring among students in secondary schools, which should be supervised by counselors and mathematics teachers.

CONTRIBUTIONS TO KNOWLEDGE

This study has revealed that mathematical resilience can be injected in students if achievement motivation and emotional intelligence strategies are properly utilized in teaching and learning of mathematics among senior secondary school two (SSS II) students in PortHarcourt Metropolis of Rivers State, Nigeria.

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