Students' psychological variables connection with secondary school students' academic performance in mathematics

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Abstract

Purpose – The study's objective was to ascertain the connection between secondary school students' test anxiety, academic self-concept, motivation and academic performance in mathematics. The difference between the academic performances of male and female secondary school students who exhibit high and low test anxiety, academic self-concept and motivation levels in mathematics.

Design/methodology/approach – Four hypotheses and four research questions were adopted. The design is a correlation. 42,299 mathematics students in senior school year two (SS2) made up the research population. A sample of 1,650 students was selected through a multi-stage sampling procedure. The main instruments used were the Mathematics Test Anxiety Questionnaire (MTAQ), Academic Self-Concept Questionnaire (ASQ) and Academic Motivation Questionnaire (AMQ) and students' math scores. These instruments were validated by three experts and the reliability coefficients of 0.69, 0.68 and 0.68 were obtained for MTAQ, ASQ and AMQ, respectively, using Cronbach alpha. Pearson product moment correlation was used to analyze the data.

Findings – The study's results showed a correlation between secondary school students' academic performance in mathematics and test anxiety, academic self-concept and motivation. There was a significant difference between secondary school male and female students' test anxiety; there was a significant difference between secondary school male and female students' self-concept and academic performance in mathematics, and there was a significant difference between secondary school male and female students' motivation and academic performance in mathematics.

Originality/value – The major contribution of this study is to investigate the connection between test anxiety, academic self-concept motivation and students' mathematics performance. There is a difference between psychological variables, gender and mathematics performance.

Keywords Gender, Test anxiety, Mathematics, Performance

Paper type Research paper

Introduction

In the contemporary world, education serves several purposes. It is committed to preserving, transforming, transferring and advancing information as well as bringing about reforms for the benefit of society. Education is significant because it is seen as a means of enhancing the human resource base for a sustainable economy and social development (Ilo & Unachukwu, 2020). According to Roohi (2012), mathematics is viewed as a discipline of science that works with numbers and their operations as well as calculation, computation and problem-solving. Das (2019) asserts that mathematics is a special discipline that fosters the growth of certain skills or knowledge in the sciences that explain the natural occurrences of social life. Mathematics helps people think more creatively and develops their mathematical and

analytical abilities (Sujata, 2017; Okigbo & Onoshakpokaiye, 2023). An understanding of mathematics gives a person the information and abilities they need to face obstacles in daily life rationally, complete a wide range of challenging activities and arrange challenging issues into orderly and understandable forms. According to Odumosu and Olusesan (2016), it is a vital nutrient for thought, logical reasoning and advancement.

The Federal Government of Nigeria (FGN, 2014) has emphasized the value of mathematics by making it explicit in the National Policy on Education that mathematics is a core and required subject for all students in elementary and secondary school. Despite the significance of mathematics and its inclusion in the Nigerian school curriculum, students' performance in internal and external examinations in the discipline has not been promising particularly in mathematics. Regardless of the significance that mathematics plays in human existence, secondary school students' performance in the subject has been described as depressing (Owan, 2020). This is seen in the National Bureau of Statistics' (2016–2021) report on the Delta state West African Examination Council (WAEC) results. The performance of the students in this crucial subject (mathematics) has to be raised.

Tests and exams have long been valued in society as a crucial and effective decision-making tool for assessing people's accomplishments, competencies and capacities (Rana & Mahmood, 2010). A sensation of fear, stress, nervousness, or unease that students encounter during tests or examinations of any kind and academic level is known as test anxiety. Test anxiety is a crucial emotional factor that affects students' motivation. Anxiety can arise from a person's incapacity to deal with situations or it might result from a person's failure to cope. Some students' could struggle with concentration or have trouble paying attention. Kendra (2020) stated that many students suffer stress and anxiety to some extent before and during exams; test anxiety can impair learning and test performance. Anxiety before a test or examination is known as test anxiety and is characterized by trembling, fear and worrying over potential failure or poor performance. In test anxiety, students feel intense tension, anxiety and discomfort before, during and after a test (Orakwue & Okigbo, 2023; Balogun, Balogun, & Onyencho, 2017; Myrna & Aida, 2015). Students' capacity to function effectively may be hampered by these emotions, which may have a detrimental impact on the student's emotional, social and behavioral growth as well as how they view themselves and their school. According to Myrna and Aida (2015), students who are less worried during a test may pay more attention to the activities that are required of them, whereas high-anxious test takers concentrate on their inner selves and the worry they are experiencing. They went on to say that test-anxious students might not do well because their focus is split between themselves and the exam; as a result, individuals with high test anxiety are unable to give the test their complete attention.

According to Zakaria, Zain, Ahmad, and Erlina (2012), students' performance in math is impacted by math anxiety. According to Zakaria *et al.* (2012), mathematics anxiety is the experience of fear, avoidance and dread while dealing with any mathematical problem. The authors also mentioned that while trying to apply their mathematical knowledge to a problem, the majority of students who struggle in math stress about the test. In the context of this study, students' reactions in mathematical testing scenarios are used to define mathematics test anxiety.

Self-concept may be quite useful in understanding and foretelling student behavior. In terms of educational growth and academic achievement, a healthy sense of self is frequently regarded as a desirable outcome (Marsh & Martin, 2011). This is the case because, according to John, Abdul-Jaleel, and Dawson-Brew (2014), one of the most significant factors affecting students' academic success is their self-concept. John *et al.* emphasized that for students to succeed academically; they must identify with the academic field and have a strong academic self-concept. Students who develop a favorable self-concept about mathematics are more likely to succeed in the subject. However, if a student views mathematics as a challenging

subject, they may grow to have a negative view of themselves and this may have an impact on their success in the course. This is known as having an academic self-concept. The ways that students have come to regard themselves and their interactions with others have a big impact on how successful or unsuccessful they are in various aspects of life.

Academic self-concept is the belief in and beliefs or impressions of one's own intellectual and academic abilities, according to Timmerman, Van Luit, and Toll (2017). The notion of oneself in academics is how that person sees himself. It refers to the ideas, opinions, attitudes, sentiments and values that a person has about his or her qualities and place in society. One's personality, physical self, personality, values, beliefs and goals all have an impact on one's self-concept. Students who feel good about themselves are more likely to accept others. Self-concept may be very helpful in describing and foretelling student behavior. The physical self, outward appearance, attire, grooming, aptitudes, disposition, values, beliefs and goals all have an impact on one's academic self-concept. Positive self-concepts are associated with greater levels of tolerance for others. The attitudes, emotions and impressions students have regarding their intellectual or academic abilities are referred to as academic self-concept.

The energizing energy that prompts, enforces and sustains behavior is known as motivation. According to Tella (2007), student motivation is a crucial component of effective learning and cannot be ignored if teachers want to ensure that students learn to their full potential. Insufficient drive to learn prevents students from achieving the required level of proficiency in the classroom. Motivation, according to Denhardt, Denhardt, and Aristigueta (2008), is "what drives people to behave as they do." According to Izuchi and Onyekuru (2017), motivation is an inner force that energizes behavior or the desire to attain a certain goal. It identifies the motivation behind people's behavior and dictates why they behave in a particular way. According to Gana, Ugwuanyi, and Ageda (2019), motivation is the need to explore new opportunities and challenges as well as to observe, learn and develop oneself. In contrast to external pressures or the desire for reward, motivation is motivated by an individual's interest or enjoyment in the work itself.

Academic motivation refers to motivation in a school environment. Students' academic competence is greatly influenced by their motivation. It stimulates and maintains students' interest in their academic pursuits, allowing them to exert the maximum amount of effort necessary to meet their intended academic objectives (Izuchi & Onyekuru, 2017; Okigbo & Onoshakpokaiye, 2023). One's efforts are stimulated by motivation, which also determines one's path. Academic motivation sparks students' interest in studying, offers incentives for them to complete academic assignments and keeps them going. According to Izuchi and Onyekuru (2017) and Moore, Armstrong, and Pearson (2008), motivation for academic success is linked to behaviors that promote learning success. Students are motivated in the classroom, which energizes their actions and behavior. Additionally, it keeps their attitudes and behaviors consistent over a longer length of time. For instance, a motivated student gives their studies their whole focus and attention, which leads to an excellent performance. When a student is committed to performing well on his or her exam, the student makes sure to choose proper behavior, such as working hard to meet the established goals.

Empirical studies
Among students at the College of Education in Akwanga, Nasarawa state, Nigeria, Nalah (2014) investigated the influence of self-concept on academic achievement. A correlation research design was adopted while three hypotheses were stated for the study. The study's sample of 412 students, including 210 first-year (NCE-1) and 202 third-year (NCE-3) freshers, was drawn at random from the research population of first-year and third-year students (NCE-1). The research found a statistically significant correlation between students' high and low self-concept and academic achievement. The results also showed that, regardless of the

academic field, there was no significant association between the self-concept of the male and female students and their academic performance, indicating that gender has no bearing on or effects one's ability to succeed academically.

To better understand the connections between anxiety, self-concept, motivation and academic achievement among public secondary school students in Delta Central Senatorial District, Delta State, Nigeria, Okoh (2016) performed a research. A correlation survey design was used. Six research questions and six hypotheses were stated. Through a simple random sampling process, 240 students were chosen as a sample from six secondary schools across three local government areas (LGAs). There was no significant connection between Students' academic performance and motivation at public secondary schools. The results showed that there was no correlation between students' academic achievement in public secondary schools and their test anxiety, self-concept, or motivation. Additionally, the results showed that gender had no apparent effect on test anxiety, self-concept, motivation and academic performance.

Students at a university in the Limpopo Province of South Africa participated in a study by Sikhwari (2014) to examine the connections between motivation, self-concept and academic achievement as well as the gender differences in these variables. A quantitative cross-sectional survey approach was used for the investigation. Through a simple random selection technique, 193 students (83 male and 110 female) students were chosen as sample from the class lists at each of the four schools. The results showed a strong relationship between self-concept, motivation and student academic performance. The results showed that there are no significant differences between male and female students in terms of their average self-concept. The average motivation of male and female students differed significantly, and female students were found to be significantly more motivated than their male counterparts, suggesting that females had higher motivation scores than males. The results also indicated that there was no significant difference in average performance between males and females.

A research carried out by Affum-Osei, Eric, Barnie, and Forkuoh (2014) to explore the connections between academic performance, academic self-concept and achievement motivation among high school students in Western Region, Ghana. This research involved a descriptive survey. 120 students were selected as a sample for the study using a stratified random selection procedure from four high schools. The results showed that a significant portion of high school students were highly motivated, had positive self-concept and did well on the Mathematics Achievement exam. According to the results, academic performance and self-concept are significantly correlated. According to the findings, there was a very strong significant relationship between students' academic performance and their self-concept, suggesting that as their sense of self-concept improves, so does their academic ability. The results showed that there was no significant association between students' accomplishment motivation and academic performance, nor was there any significant correlation between achievement motivation and self-concept. The results showed that, in comparison to female students, the majority of male students had higher self-concept scores, indicating that they were highly driven. The findings indicated that male students outperformed their female counterparts on the achievement exam, which may be because male students were more driven than female students. The results also showed a connection between academic success, achievement motivation and self-concept.

Awan, Noureen, and Naz (2011) performed a research in secondary schools in the Sargodha area of Punjab, Pakistan, to investigate achievement in English and mathematics and its connections to motivation for academic success and self-concept. A correlation research design was used. The results revealed a significant association between the three variables of academic achievement, achievement motivation and self-concept, indicating that student self-concept and motivation are highly associated. According to the results, academic

performance is significantly correlated with self-concept and achievement motivation. The relationship between self-concept and academic performance was shown to be quite important. Math achievement and self-concept were significantly correlated. The findings revealed that there were significant gender differences which were in the favor of the females. The findings also revealed that female students have more positive self-concept both in Mathematics and English when compared to their male counterparts.

In research, Dramanu and Mohammed (2017) looked at the academic performance and motivation of junior high school (JHS) students in Ghana as well as the differences between male and female students and students from urban and rural schools. The investigation is guided by three hypotheses. All second-year students in Ghana's public JHSs made up the study's population. Through a stratified random sampling process, 1470 JHS 2 students (756 male and 714 female) were chosen as a sample from the 24 JHSs. The results showed a link between JHS students' academic achievement and academic motivation. The results showed that there was a statistically significant correlation between urban and rural students' academic motivation and performance. Additionally, it showed that there was no statistically significant difference in the level of academic desire between male and female students at JHSs in Ghana.

An investigation of test anxiety as a predictor of academic success among secondary school students in Anambra State, Nigeria was undertaken by IlO and Unachukwu (2020). A correlation survey design was used. The study was led by two research questions and two hypotheses. Through a multi-stage sampling approach, a sample of 943 SS2 students was chosen. The results showed that test anxiety is a predictor of students' academic performance in the subjects of English language and mathematics.

An investigation of the connection between university students' exam anxiety and academic performance was conducted by Özgan, Karakılıç Binici, Ustaoglu, and Ayhan (2019) in Ankara, Turkey. The study design used was a correlation. To direct the investigation, two hypotheses were put forth. A random selection approach was used to choose 150 student samples, 114 of whom were female and 36 of whom were male. The results showed that there was no connection between test anxiety and academic achievement. Their findings demonstrated that students' high levels of anxiety are unrelated to their academic achievement. Additionally, they discovered a link between test anxiety and academic performance that was negative.

Among students at the College of Education, Arts and Sciences, Lyceum of the Philippines University, Batangas City, Philippines, Myrna and Aida (2015) conducted a study to ascertain the relationship between the performance of the students in the area of mathematics, specifically in algebra and trigonometry and their test anxiety. The study design used was one of descriptive correlation. The results showed a significant correlation between test anxiety in mathematics and mathematics performance. This suggests that a student's trigonometry ability may have an impact on their exam anxiety for mathematics. The results showed that test anxiety interferes with students' capacity to concentrate on their academic work, which has a detrimental impact on their marks.

Research on exam anxiety and academic achievement of senior secondary school students in geometry in 17 LGAs of Enugu state, Nigeria, was undertaken by Chukwu (2014). The chosen study design was a correlation survey. The study was led by five research questions and five hypotheses. All male and female senior high school two students in all of Enugu State's public secondary schools make up the study's population. The study's sample, 388 senior secondary school students who were selected using a multi-stage selection technique, included 200 male and 188 female students. The findings showed a moderately positive link between test anxiety and students' academic performance in geometry. The mean test anxiety of male and female students differed significantly, with the male students having higher test anxiety.

Students from four schools in the Vhembe District of South Africa participated in a research by James, Tawanda, Ndileleni, Hasina, and Shonisani (2021) to determine the relationship between mathematics self-concept and academic accomplishment. It was a correlation design. Three hypotheses were stated. In South Africa's Vhembe District, four secondary schools were used to choose a sample of 236 respondents (112 male and 124 female) using a stratified random sampling approach. The results showed that mathematics self-concept significantly and positively impacted academic performance. The results demonstrated that there were no gender disparities in Grade 12 students' academic performance and self-concept in mathematics. This suggests that the academic performance and self-concept of the male and female students in mathematics were not significantly different.

In Varanasi, India, Jaiswal and Choudhuri (2017) did a study to compare the academic self-concept of male and female secondary students and to investigate the association between academic self-concept and academic achievement of secondary students. There were two hypotheses. A sample of 615 secondary school students, 317 males and 298 females, between the ages of 14 and 17, from 15 secondary schools connected with the Central Board of Secondary Education (CBSE) board in Varanasi city, India, were chosen via a multi-stage random selection technique. The results showed a gender difference in the students' academic self-concept, with female students having a higher academic self-concept than male students. This suggests that male and female secondary school students have different views about their academic beliefs and capacities. Greater academic achievement goes hand in hand with a greater academic self-concept.

In the metropolis of Ibadan, Oyo state, Nigeria, Kamoru and Ramon (2017) did research to investigate the link between mathematics achievement, student attitude toward mathematics and self-concept. A correlation design was used in this investigation. The study has four main research questions. All secondary school students in Oyo state, Ibadan metropolitan make up the study's population. In six secondary schools' class two (SS2), a sample of 200 students (124 female and 74 male) were randomly selected using a stratified sampling approach. The results showed a significant correlation between students' self-concept and mathematics performance. The results showed that there was no gender-related difference in self-concept that was statistically significant.

In Ankpa LGA, Kogi State, Nigeria, Adown (2016) looked at the students' attitudes and self-concept in relation to their performance in senior secondary school mathematics. The study design used correlation. The study is guided by five research questions and five hypotheses. All 3,301 students in senior secondary one (SS1) Mathematics from Ankpa LGA in Kogi State, Nigeria, were the study's target group. With the use of stratified and simple random selection techniques, a sample of 332 students (166 male and 166 female) was selected. The results showed a strong correlation between students' self-concept and their academic performance in senior high school mathematics. The self-concept of male and female students differed significantly in secondary school mathematics, favoring female students, as did their academic performance. There was no significant relationship between students' self-concept and their academic achievement in mathematics based on gender, but there was a significant relationship between these variables based on students' self-concept and academic achievement in mathematics based on gender.

To better understand how students' gender and test anxiety affect their academic performance in mathematics at the SS3 level in the Calabar Education Zone of Cross River State, Nigeria, Esuong and Udo (2022) performed a research. The chosen study design was ex post facto. The study followed two hypotheses. Through a stratified random selection technique, a sample of 456 SS3 students was chosen from nine schools in the zone. According to the findings, males do much better academically than females in mathematics. Additionally, the results showed that test anxiety had a significant negative influence on students' academic achievement in mathematics.

Research by Abo Hamza and Helal (2013) on math anxiety in college students of various majors: There were two hypotheses stated for the study. A survey research design was employed for this investigation. 161 undergraduate students from the University of Arkansas in the United States and 169 undergraduate students from Tanta University in Egypt made up the sample. The SPSS package program, version 17, was used to analyze the data. Their study revealed that both the Egyptian and the American undergraduate students' mathematics anxiety was shown to be unaffected by gender. Their study also revealed that math anxiety levels were similar for males and females.

Long-term research has examined the relationship between gender and math anxiety levels, but no conclusions have been made yet (Abo Hamza & Helal, 2013). There are no appreciable variations in mathematics anxiety levels between male and female college students, according to Haynes, Mullins, and Stein (2004) study. Malinsky, Ross, Pannells, and McJunkin (2006) and Khatoon and Mahmood (2010) both found that female college students have much higher levels of math anxiety than their male counterparts.

The following gaps in the literature were found to exist: there was no research showing the present investigation, test anxiety, academic self-concept and motivation as correlates of students' performance in mathematics, particularly in Delta state, had been conducted. The results of combining variables relating to male and female students appear to be ambiguous and conflicting. Additionally, Delta State has yet to conduct this kind of empirical investigation. Therefore, an in-depth examination of research of this kind is required to clarify this idea. In secondary schools in Nigeria, it is crucial to raise students' academic performance in mathematics. Therefore, it would be essential to comprehend some psychological variables that affect the performance of students in mathematics to aid in this improvement. As a result, this study explores the connection between secondary school students' test anxiety, academic self-concept and academic motivation, as well as their academic performance in Mathematics in Delta State Nigeria.

The study specifically set out to look into:

(1) The connection between test anxiety, academic self-concept, academic motivation and academic performances of secondary school students in Mathematics

(2) The difference between the academic performances of male and female secondary school students who exhibit high and low test anxiety levels in mathematics

(3) The difference between the academic performances of male and female secondary school students who exhibit high and low self-concept levels in mathematics

(4) The difference between the academic performances of male and female secondary school students who exhibit high and low motivation levels in mathematics

Statement of the problem

Despite government initiatives to improve mathematics instruction and learning, secondary school students consistently and negatively do poorly in mathematics. This poor level of student performance in mathematics has been linked to several factors, including a lack of classroom space, a paucity of mathematics teachers with the requisite training, student learning skills and others. Math competency among students has not increased, according to data from the National Bureau of Statistics' WAEC scores for Delta State (2016–2021). This could be brought on by the students' aversion, fear, or hate of mathematics. For several reasons, many secondary school students opt not to study or attend math classes. As a result, they under-prepare for math exams, which have a detrimental impact on their math performance. The researcher was motivated by these problems to conduct this study to determine if test anxiety, self-concept and motivation are psychological factors that could

contribute to the problems associated with poor academic performance in secondary mathematics in Delta State, Nigeria.

Method

This study used the correlation survey design. The 42,299 senior secondary school two (SS2) mathematics students from public secondary schools in Delta State, Nigeria, made up the study's population. The study's sample was chosen utilizing a multi-stage sampling approach with four levels using the balloting technique. The education zones made up the first level of sampling. Delta State is divided into 11 educational zones, which serve as the sampling units. One LGA from each of the education zones was randomly chosen to receive 11 (LGA$_S$) for the second stage of sampling. The balloting method was used as a third level of sampling, where two schools were chosen from each of the 11 (LGA$_S$). All of the students from the 22 schools were chosen using a simple random sampling technique. As a fourth level of sampling using simple random sampling, 75 SS2 students from each of the 22 schools were chosen. Using the Multi-stage sampling approach, 1650 (771 male and 879 female) from 22 Senior Secondary Schools Two (SS2) were chosen as a sample.

The instruments utilized to gather the data were the Academic Self-concept Questionnaire (ASQ), the Mathematics Test Anxiety Questionnaire (MTAQ) and the Academic Motivation Questionnaire (AMQ). The instrument was modified by the researcher from the original instruments. The changes are consistent with the study's objective. Each of the three instruments is made up of two parts: Part A of each instrument is concerned with data on demographic characteristics. Each instrument's second part B measures the students' test anxiety, academic self-concept and motivation.

The first instrument, the MTAQ, has 50 items and was constructed to gather data on the students' test anxiety in mathematics. It was adapted from Dawood, Al Ghadeer, Mitsu, Almutary, and Alenezi (2016). The second instrument, the Academic Self-Concept Questionnaire (ASQ), contains 50 items and was designed to gather data on the students' academic self-concept in mathematics. It was modified from Oluwatayo (2011). The third instrument, the AMQ, which has 50 items, was created to gather data on the students' academic motivation in mathematics which was adapted from Shia (2022), Okigbo and Onoshakpokaiye (2023). Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD) are the four scales used by the three instruments. Three experts validated the instruments. 150 students from three separate mixed secondary schools who were not included in this study were given the instrument as a pilot study to check its internal consistency. The reason for using these three different schools is to prevent contamination. When the MTAQ, ASQ and AMQ items' internal consistency was assessed using Cronbach's alpha statistics, the corresponding alpha coefficient values of 0.69, 068 and 0.68 were achieved.

The results of the students for the three terms of the 2021–2022 school years were requested from the sampled schools to get their Mathematics scores, which were then utilized to assess the students' performance in mathematics. The data were examined using a Pearson product moment correlation and SPSS.

Results

RQ1. What is the connection between test anxiety, academic self-concept, academic motivation and academic performances of secondary school students in Mathematics?

Table 1 shows that there is a low positive relationship (R = 0.147) between students' test anxiety, self-concept, motivation and academic performance in mathematics. The coefficient

of determination of 0.022 as shown in Table 1 revealed that 2.2% of students' academic performance in Mathematics is accounted for by test anxiety, academic self-concept and motivation.

H1. There is no significant correlation between secondary school students' test anxiety, academic self-concept, motivation and academic performance in Mathematics.

To determine if these relationships are significant multiple regressions was used to test the data collected.

From Table 2, the result of the regression indicated the F (36.488), sig (2tail = 0.000). With a sig value of 0.000 which is less than 0.05, the null hypothesis is rejected which implies that there is a significant correlation between secondary students' test anxiety, academic self-concept, motivation and academic performance in mathematics.

RQ2. What is the difference between the academic performances of male and female secondary school students who exhibit high and low test anxiety levels in mathematics?

Table 3 revealed that 35.2% of the male students had high anxiety while 11.5% of the male students had low anxiety. Also, Table 3, indicates that 48.5% of female students had high anxiety while 4.8% of female students had low anxiety. This implies that most of the students who exhibit math anxiety are female students, which indicates that female students are more math-anxious than male students.

RQ3. What is the difference between the academic performances of male and female secondary school students who exhibit high and low self-concept levels in mathematics?

Model	R	R^2	Adjusted R^2	Std. Error of the estimate
1	0.147[a]	0.022	0.021	12.10537

Note(s): a. Predictors: (Constant), AMS
Source(s): Author's own

Model	Sum of squares	Df	Mean square	F	Sig
Regression	5346.985	1	5346.985	36.488	0.000[b]
Residual	241497.822	1648	146.540		
Total	246844.807	1649			

Note(s): [a]Dependent variable: Academic performance
[b]Predictors: (Constant), test anxiety, self-concept and motivation
Source(s): Author's own

Gender	Levels	N	%	*t*-value	*p*-value
Male	High anxiety	582	35.2	6.78	0.000
	Low anxiety	189	11.5		
Female	High anxiety	800	48.5		
	Low anxiety	79	4.8		
Total		1650	100		

Source(s): Author's own

In Table 4 we discovered that 44.5% of the male students had high self-concept while 2.2% of the male students had low self-concept. Also, 52.5% of the female students had a high self-concept while 0.8% of the female students had a low self-concept. From Table 4 above, students who exhibited more positive self-concept are the female students. It implies that the female students had a higher self-concept than the male students in mathematics.

RQ4. What is the difference between the academic performances of male and female secondary school students who exhibit high and low motivation levels in mathematics?

From Table 5, 39.9% of the male students had high motivation while 6.8% of them had low motivation. Also, 52.3% of the female students had high motivation while 1.0 of them had low motivation. This implies that the female students are highly motivated compared to the male students since they had higher percent.

H2. There is no significant difference between the academic performances of male and female secondary school students with high and low test anxiety levels in mathematics

Since the *p*-value (0.000) in Table 3 is less than the significance level of 0.05, there is a significant difference. The null hypothesis, which states that there is no significant difference between the academic performances of male and female secondary school students who exhibit high and low test anxiety, is therefore rejected. The results showed that male and female students who exhibit high and low levels of mathematical anxiety differed significantly in their academic performance (t = 6.78; *p* = 0.05). In Table 3 above the females are more mathematics anxious. This suggests that the male students performed better in math than the female students in math.

H3. There is no significant difference between the academic performances of male and female secondary school students who exhibit high and low self-concept levels in mathematics

Since the *p*-value (0.000) in Table 4 is less than the significance level of 0.05, there is a significant difference. The null hypothesis, which states that there is no significant difference between the academic performances of male and female secondary school students who

Gender	Levels	N	%	*t*-value	*p*-value
Male	High self-concept	734	44.5	8.76	0.000
	Low self-concept	37	2.2		
Female	High self-concept	866	52.5		
	Low self-concept	13	0.8		
Total			100		

Table 4.
Comparative results of male and female students' self-concept percentage and academic performance

Source(s): Author's own

Gender	Levels	N	%	*t*-value	*p*-value
Male	High motivation	658	39.9	5.79	0.000
	Low motivation	113	6.8		
Female	High motivation	863	52.3		
	Low motivation	16	1.0		
Total		1650	100		

Table 5.
Comparative results of male and female students' motivation percentage and academic performance

Source(s): Author's own

exhibit high and low self-concept levels in mathematics, is therefore rejected. The results showed that male and female students who exhibit high and low levels of academic self-concept differed significantly in their academic performance (t = 8.76; p = 0.05). In Table 4 above the female students exhibit more high self-concept than the male students in math. This suggests that the female students performed better in math than the male students since they possessed high self-concept.

    H4. There is no significant difference between the academic performances of male and female secondary school students who exhibit high and low motivation levels in mathematics

Since the p-value (0.000) in Table 5 is less than the significance level of 0.05, there is a significant difference. The null hypothesis, which states that there is no significant difference between the academic performances of male and female secondary school students who exhibit high and low motivation levels in mathematics, is therefore rejected. The results showed that male and female students who exhibited high and low levels of academic motivation differed significantly in their academic performance (t = 5.79; p = 0.05). In Table 5 above the female students exhibit more of high motivation than the male students in math. This suggests that the female students performed better in math than the male students since they possessed more high motivation.

    Figure 1 shows the number of male and female students who had low and high math anxiety, academic self-concept and motivation in mathematics performance. Male high anxiety (MHA) 582, Male low anxiety (MLA) 189, Male high self-concept (MHSC) 734, Male low self-concept (MLSC) 37, Male high motivation (MHM) 658, Male low motivation (MLM) 113, Female high anxiety (FHA) 800, Female low anxiety (FLA) 79, Female high self-concept (FHSC) 866, Female low self-concept (FLSC) 13, Female high motivation (FHM) 863 and Female low motivation (FLM) 16. Figure 1 show that the females exhibited more math anxiety than the male students, the females exhibited higher self-concept than the males and the female students possessed higher motivation in math than the male students.

Discussion
There is a connection between secondary school students' test anxiety, academic self-concept, motivation and their mathematics academic performance
The null hypothesis, which states that there is no significant relationship between test anxiety, academic self-concept and motivation and secondary school students' academic
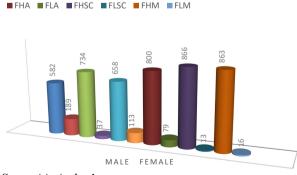

Figure 1.
Math anxiety, self-concept, motivation levels of male and female students in math performance

Source(s): Author's own

performance in mathematics, is thus rejected in light of Table 1 finding that there is a correlation between secondary school students' test anxiety, self-concept and motivation. The results of the current study concur with those of Izuchi and Onyekuru (2017), who found a strong and positive link between students' academic performance, academic motivation and academic self-concept. Since academic performance, motivation and self-concept were highly associated with one another. This suggests that children who repeatedly achieve high levels of academic performance in mathematics tend to develop confidence, which can inspire or assist in generating the drive required for continuing high levels of academic performance. In their study, Awan et al. (2011) looked at students' performance in English and Mathematics in secondary schools and how it related to their motivation for learning and self-concept. Their research showed a significant association between the three variables self-concept, achievement motivation and academic performance, which supports the results of the current study. This suggests that students' self-concept and achievement motivation are significantly connected. It also showed that achievement motivation and self-concept are significantly related to the academic performance of students in mathematics.

Sikhwari (2014) and Affum-Osei et al. (2014) findings revealed that there were significant correlations between self-concept, motivation and academic achievement of students which agrees with the study findings. This implies these psychological variables jointly contribute to students' academic performance in mathematics. IlO and Unachukwu (2020) study revealed that test anxiety is a predictor of academic achievement of students in English language and Mathematics which supported the present study findings. Özgan et al. (2019) in their study showed that the high level of anxiety of students is not related to academic performance which does not support the study's present findings. Myrna and Aida (2015) study findings revealed that there was a significant relationship between Mathematics test anxiety and performance in Mathematics which corroborated with this study. This implies that the students' Mathematics test anxiety is affected by their performance in mathematics. The findings indicated that test anxiety inhibits the ability of students to focus on academics which negatively influences grades.

Balogun et al. (2017) findings revealed that achievement motivation had a significant positive relationship with test anxiety and academic performance which supported the findings. The achievement motivation significantly moderated the relationship between test anxiety and the academic performance of the students in mathematics. Achievement motivation and test anxiety interacted to influence academic performance which implies that achievement motivation significantly moderated the effect of test anxiety on the student's academic performance in mathematics which resulted in good performance. Okoh (2016) study revealed that there was a significant relationship between anxiety, self-concept, motivation and academic performance of students in public secondary schools which is in agreement with the study findings. This implies that anxiety, self-concept and motivation influence the academic performance of secondary school students in mathematics.

Onukwufor and Ugwu (2017) and Affum-Osei et al. (2014) study revealed there was a significant relationship between test anxiety, self-concept, achievement motivation and academic performance of the students which is in agreement with the present study findings. This indicates that test anxiety, self-concept and achievement motivation jointly and independently significantly predicted secondary school students' academic performance in mathematics. Jaiswal and Choudhuri (2017) study revealed that there was a positive and significant relationship between academic self-concept and academic achievement of secondary school students which is in agreement with the present study.

In the study of Chukwu (2014), it was revealed that there was a moderate positive relationship between test anxiety and academic achievement of students in geometry which supported this study. The findings of Gachigi (2018) revealed that academic self-concept positively and significantly predicted mathematics achievement and also revealed that

academic motivation and mathematics achievement were significantly related which supported this study. James *et al.* (2021) and Adown (2016) findings revealed that mathematics self-concept positively and significantly predicted academic achievement which also supported the present study.

Difference between the academic performances of male and female secondary school students with high and low test anxiety levels in mathematics
The study by Chukwu (2014) revealed that there was a significant difference in test anxiety between male and female students with the male students having high test anxiety which does not support this study. From this study, the female students had higher test anxiety than the male students which implies that the male do better in mathematics than the female students. Esuong and Udo (2022) study revealed that males and females differ significantly in their academic performance in mathematics in favor of males which supported this study. In this study, it was revealed that the female students had high math anxiety compared to the male. This implies that males do better in math than female students since they possess low math anxiety.

Owan (2020) carried out a study which revealed that there was no significant gender difference in performance and test anxiety which is in disagreement with the present study. The findings of Gachigi (2018) revealed that there were no significant gender differences in the three predictor variables (academic self-concept, motivation and resilience) and mathematics achievement. Gender had no significant influence on academic motivation and academic self-concept which do not support this study.

In contrast to the current study, Abo Hamza and Helal's (2013) study on math anxiety in college students of all majors found that gender had no impact on math anxiety among Egyptian or American undergraduate students and that males and females had similar math anxiety scores. According to Haynes *et al.* (2004), there are no appreciable variations between male and female college students' levels of math anxiety, which also contradicts the results of the current study.

There is a difference between the academic performances of male and female secondary school students with high and low self-concept levels in mathematics
Gachigi (2018) findings revealed that there were no significant gender differences in the three predictor variables (academic self-concept, motivation and resilience) and mathematics achievement which do not support the findings that state that there is a significant difference between male and female self-concept and their academic performance. James *et al.* (2021) findings revealed that there were no significant gender differences in mathematics self-concept and academic achievement which do not support this study. In this study, there was a significant gender difference in mathematics self-concept and academic performance. The male and female students were significantly different in mathematics self-concept and academic performance. The females have higher academic self-concept compared to the male students.

Jaiswal and Choudhuri (2017) study revealed that there was a gender difference in the academic self-concept of the students, the female students having higher academic self-concept than that of the male students which agrees with this study. This implies that both male and female students at the secondary level have different views about their academic beliefs and capabilities. Also, higher academic self-concept is accompanied by higher academic achievement. Kamoru and Ramon (2017) findings do not agree with the present study, according to their findings there was no significant difference in gender for self-concept. The present study states that there is a significant difference between male and female self-concept and their performance in mathematics.

Adown (2016) findings revealed that there was a significant difference between the male and female students' self-concept and their academic achievement in secondary school Mathematics which was in favor of female students. This agrees with the study. Nalah (2014) findings revealed that there was no significant relationship between the male and female students' self-concept and their academic performance regardless of their academic domain, which suggests that gender, does not influence or determine one's self-concept and academic performance which does not support this study's finding. Okoh (2016) and Sikhwari (2014) findings revealed that male and female students do not differ significantly in their average self-concept which does not agree with the study. Awan *et al.* (2011) study findings revealed that there were significant gender differences in self-concept and academic performance of male and female students in mathematics, which was in the favor of the females which supported the present study findings The findings revealed that females students have more positive self-concept in Mathematics when compared to their male counterpart.

Difference between the academic performances of male and female secondary school students with high and low Motivation levels in mathematics
The present study is contrary to the study of Affum-Osei *et al.* (2014) findings which revealed that the majority of male students have recorded high motivation compared to female students. The present findings revealed that the female students were highly motivated compared to male students.

Dramanu and Mohammed (2017) and Okoh (2016) findings revealed that there was no statistically significant difference between academic motivation which is contrary to the present study which states that there was a significant difference between the academic motivation of male and female students and their academic performance in mathematics. Sikhwari (2014) conducted a study which revealed that there was a significant difference between the average motivation of male and female students and that female student are significantly more motivated than their male counterparts which agree with the study. This implies that females have higher motivation scores than males which will also contribute to their academic performance in mathematics.

Conclusion
The study's findings revealed that test anxiety, self-concept and motivation were jointly significant and connected to secondary school students' academic performance in mathematics. Additionally, it was shown that there was a significant difference in test anxiety of male and female students and their academic performance in mathematics, there was a significant difference in self-concept of male and female students and academic performance in mathematics and there was a significant difference in motivation of male and female students and academic performance in mathematics.

Recommendations
From the findings the following recommendations were made:
To lessen secondary school students' test anxiety over cognitive exams, math instructors should make sure test surroundings are comfortable.

To improve the student's academic performance in mathematics, parents, guardians and school administration should collaborate to reduce test anxiety, promote a positive self-concept and boost motivation in students.

Mathematics instructors should be given the resources they need through training to reduce exam anxiety and boost students' confidence and interest in the subject, as a result the students' academic performance would increase.

To ensure a long-lasting and fruitful improvement of students' academic performance, teachers and parents should work to reduce test anxiety while simultaneously enhancing students' academic self-concept, motivation and performance in mathematics.

Since test anxiety, self-concept, motivation and academic performance would undoubtedly improve as a result, the study urged teachers to constantly make mathematics sessions more attractive and engaging for students.

Implications of the findings

According to the study's results, test anxiety, academic self-concept and motivation were all significant predictors of secondary school students' academic performance in mathematics, regardless of gender. This suggests that all three of these variables have to work together for students' mathematical proficiency.

To improve students' academic performance in mathematics, teachers and other stakeholders need to assist them developing low test anxiety, a positive self-concept and high motivation. Otherwise, secondary school students' academic performance in mathematics will remain subpar. Another implication of this study is that, without proper orientation from the school administration, the government and professional bodies regarding the significance of having low test anxiety, a positive self-concept and high motivation, students may not be aware that these three variables are jointly and independently related to their academic performance in mathematics, which will lead to an increase in standard in their academic performance.

Suggestions for further research

For more investigation, the researcher suggests the following.

(1) The association between academic self-concept and goal orientation among Delta State secondary school students.

(2) The research was limited to examining the relationships between test anxiety, academic self-concept, motivation and secondary school students' academic performance in mathematics in Delta State, Nigeria. It may be duplicated with students from senior high schools in different nations.

(3) Only the relationship between test anxiety, academic self-concept, motivation and secondary school students' academic performance in mathematics in Delta State, Nigeria was the subject of the study. It can be duplicated using the university students.

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