CORRELATION BETWEEN AFFECTIVE VARIABLES AND STUDENTS' ACADEMIC PERFORMANCE IN MATHEMATICS IN SOUTHWESTERN UNIVERSITIES, NIGERIA

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Abstract
This study examined the inter-relationships between affective variables and performance in Mathematics of Southwestern Nigerian Universities students. A total of 755 male and female students, purposively selected from seven departments were involved in the study. Three instruments were employed namely: Mathematics Self-concept Scale (r = 0.63), Mathematics Self-efficacy Scale (r = 0.79) and Mathematics Anxiety Scale (r = 0.82). Students' performance in mathematics (PIM) was determined by the average scores obtained in their mathematics courses. Using linear regression, the results revealed that, for both male and female students, Mathematics self-concept (MSC) and Mathematics self-efficacy (MSE) had a significant joint effect on PIM. However, only MSE demonstrated a significant relative effort on PIM. The results also showed that both Mathematics anxiety (MAX) and Mathematics self-efficacy (MSE) have significant joint effect on PIM and that only MSE also has relative effort on PIM. It is, therefore, suggested that affective variables should be considered along with other factors of performance in Mathematics in our attempt to improve upon university students' performance in Mathematics.

Key words: Sex, Self-concept, Self-efficacy, Anxiety and Performance in Mathematics (PIM)

Introduction

Mathematics is a vital subject, essential in our daily lives and taught in all academic institutions all over the world; kindergartens, primary schools, secondary schools, pre-university colleges as well as at higher institutions. Mathematics, according to Adeyinka, Adeniyi, and Oyedeji (2020), is a subject that significantly impacts various aspects of human life, influencing them to differing degrees. At higher levels of education, mathematics serves as a fundamental requirement for most programs of study. Moreover, mastering mathematical skills serves as a crucial indicator of a student's potential for success across all levels of academic pursuit.

Despite the crucial role of mathematics as a prerequisite for success in various fields of study (Ogunniyi & Okereke, 2020) and its significant impact on individuals' daily lives, problem-solving skills, and critical thinking (Nicol & Crespo, 2018), mathematics remains a challenging subject for many students. Furthermore, students' aversion to mathematics often produces a spill-over effect, negatively impacting their learning in other subjects that depend heavily on mathematical concepts (Ogunkola, 2020; Ige, 2022). Previous studies (Ugwu & Onyije, 2020; Adeyemi & Afolabi,

2019), have highlighted several student-related factors such as gender, mathematics self-efficacy, mathematics self-concept, and math anxiety - that significantly influence students' performance in the subject.

The development of every nation depends on the active participation of its citizens, both males and females. Equipping both sexes for effective contribution to the nation's development is therefore very much important in our educational setting. It is believed that people can manage their personal life as well as professional duties when they are well educated, and mathematics as a subject has proved itself an indispensable tool for the development of a person and the nation as a whole. This has made mathematics receive a lot of recognition in many parts of the world. As a result, many researchers and stakeholders have developed a growing interest in finding out students' performances in mathematics due to its importance within and across the educational curricula. Although research suggests that gender differences in mathematics learning are unclear during elementary school years, studies indicate that boys tend to outperform girls in mathematics during intermediate school years, a trend that persists into high school (Lavy & Sand, 2018).

A study by Oyediran, Oyediran and Ajibade (2022) investigate the expectations of male and female students in undergraduate mathematics courses in Nigerian universities. The results show no significant difference in confidence levels between males and females regarding completing their bachelor's program. However, females expressed lower confidence than males in pursuing master's or doctoral degrees. Research also highlights the disparity in confidence levels between females and males, even among those with similar confidence levels (Afolabi, 2020). Furthermore, a study by Adejumo (2019) finds that female students in Nigerian universities were more likely to switch from mathematics-related majors to non-mathematics fields.

Sex-differences in perceived usefulness of mathematics are often linked to the stereotype that mathematics is a male male-dominated domain. This stereotype persists in Nigerian society, where males dominate careers that heavily rely on mathematics, such as engineering, surveying, and laboratory technology (Adegoke, 2020). Furthermore, the Nigerian education system reinforces this stereotype by emphasizing the contributions of male mathematicians and scientists, such as Einstein, Newton, and Pythagoras, while overlooking the achievements of female scientists (Ogunniyi, 2017). As a result, females may avoid mathematics, perceiving it as a male-dominated field. He adds that mathematics is seen as a difficult and most feared subject by students especially females.

Research on the biological factors influencing the performance gap between male and female learners suggests differences in brain structure, hormone production, and maturation rates may contribute to variations in academic performance (Okebukola & Oyedeji, 2020). Furthermore, studies have shown that the brain regions responsible for processing verbal information and facilitating inter-hemispheric communication are more developed in females (Adebesin, 2019). Research suggests that girls exhibit earlier development in brain regions responsible for impulse control and emotional regulation (Adeyemo, 2023). In addition, studies have shown that the brain's structure and function differ between males and females, influencing learning and academic performance (Ogundokun, 2023).

Gender remains a widely debated variable in educational research, with conflicting findings. Some studies suggest a significant relationship between gender and mathematics performance, favouring boys (Oguntade, 2022). Research indicates that male students tend to outperform their female counterparts in science, technology, engineering, and mathematics (STEM) subjects (Afolabi, 2020). Boys often excel in numerical aptitudes, spatial reasoning, and science, while girls tend to perform better in verbal fluency, memory, and manual agility (Adeyemo, 2022). However, other studies found no significant gender-based

differences in mathematics achievement scores (Okoro, 2020; Eze, 2022).

Research has shown that gender differences exist in mathematics classes, particularly in cognitive processes related to problem-solving. A study by Oyedotun (2022) finds that girls tend to rely on memorization, while boys employ more complex problem-solving strategies. Furthermore, girls are less likely to develop the motivational characteristics necessary for achieving success in mathematics and science, especially at higher grade levels (Adeyemo, 2022). Likewise, research by Okoro (2020) indicates that girls report lower confidence than boys in their ability to perform well on mathematics tasks in the classroom. Mathematics and sciences are often perceived as masculine domains of achievement (Eze, 2022).

The issue of gender disparity in science and mathematics achievement remains a topic of investigation, even at the tertiary level of education, with no consensus yet on which group performs better. Research in Nigeria has consistently shown that women's participation and achievement in science, technology, engineering, and mathematics (STEM) fields are significantly lower than those of their male counterparts (Adeyemi, 2022). According to Ajayi (2020), factors such as societal expectations, cultural norms, and limited access to resources contribute to the low level of women's achievement in STEM fields. Furthermore, research by Okoro (2022) highlights the intersectionality of gender with other factors such as ethnicity, social class, and disability, which can heighten existing disparities in STEM education.

The study of self-concept has gained significant attention in psychological research in recent years. According to Adeyemo (2022), self-concept encompasses various dimensions, including academic and non-academic components. Academic self-concept is further divided into subject-specific self-concepts, such as mathematics and English, while non-academic self-concept includes social, emotional, and physical components (Okoro, 2020). Research by Oyedotun (2022) supports the notion that academic self-concept is a significant predictor of academic achievement, particularly in core subjects like mathematics and English.

Self-concept plays a crucial role in social competence, influencing an individual's feelings, thoughts, learning, self-value, relationships, and behavior (Adeyemo, 2022). Research by Oyedotun (2022) highlights the motivational properties of academic self-concept, suggesting that changes in academic self-concept can lead to changes in subsequent academic achievement. Furthermore, studies by Okoro (2020) and Ajayi (2022) support the reciprocal relationship between self-concept and academic achievement, indicating that prior academic achievement affects subsequent academic self-concept, and vice versa. This suggests that a negative attitude towards a particular subject, resulting from low self-concept, can lead to decreased confidence and lower achievement in that subject.

Psychologists have paid a lot of attention to factors related to the formation and development of self-concept. This issue is very important to the field of mental health, as an individual's conception of his or her person, which is linked to the personality, to a certain extent determines the attitude of that person to his or her environment, and to a larger extent the person's academic performance. It may then be suggested that if self-concept is positive and normal, the individual will possess normal mental health. Unfavourably, if self-concept is negative and abnormal, the individual may behave abnormally in his or her environment. The implication is that good mental health (resulting from positive self-concept) makes for positive academic.

Research has consistently shown a significant correlation between self-concept and academic performance. According to Oyedotun (2022), there is a reciprocal relationship between academic self-concept and subsequent achievement, indicating that positive self-concept can enhance student achievement, while better student achievement can also improve self-concept. Similarly, Adeyemo (2022) finds that a positive self-concept is a potential

facilitator of motivation and performance, while Okoro (2020) notes that self-concept of academic ability has a positive relationship with achievement over time. Therefore, it can be deduced that the better the self-concept of academic ability, the higher the academic performance, and changes in self-concept will have a corresponding effect on academic performance.

Akomolafe and Ogunsola (2020) investigate the relationship between self-efficacy, test anxiety, and academic performance among Nigerian university students. The findings revealed that low self-perceived academic competency negatively affected students' Grade Point Average (GPA). In short, high test anxiety negatively affected self-perceived academic competency. The study also finds a positive correlation between self-perceived academic competency and academic performance. Thus, students with low self-concept tend to perform poorly academically. Oyediran et al (2022) in their study on mathematics self-efficacy and academic performance among Nigerian secondary school students show that students' personal factors, including self-efficacy, predicted their academic achievement in mathematics. According to the results obtained from this study, students' low or high performance is due to their personality factors, and the more students improved on their self-concepts, determinations, and high interest, the better their performance in mathematics.

Another study by Adejumo (2020) on the relationship between self-efficacy and mathematics achievement among Nigerian senior secondary school students reveals that students with high self-efficacy tend to achieve better in mathematics than those with low self-efficacy. Furthermore, a study by Ogunniyi et al (2020) finds that self-efficacy was a significant predictor of mathematics achievement among Nigerian secondary school students. Many students doubt their capabilities to succeed in mathematics, being one of the most dreadful subjects in schools. Mathematics, as one of the compulsory subjects in the Nigerian educational system, has been a major problem to students from primary level to higher institution. Students believe that mathematics is meant for some selected students because they lack a sense of efficacy. They believe that they can never do well in mathematics, no matter the effort they put in. As a result, it has become a major concern within the Nigerian educational system and globally. Many students are underperforming in mathematics, largely due to low levels of self-efficacy. According to Oyediran, et al (2022), when students begin engaging with a task, they consider several personal and contextual factors, such as their perceived ability, the difficulty of the task, the amount of effort required, the available of support, and their past experiences of success or failures.

Oyediran et. al (2022) assert that self-efficacy (a student's confidence in his or her ability to overcome challenges to attain specific goals) influences how students respond. Thus, self-efficacy predicts choices students make about how to engage with tasks: a person with the same knowledge and skills may perform poorly, adequately, or extraordinarily depending on fluctuations in self-efficacy beliefs (Oyediran et. al, 2022). Ogunniyi et. al (2020) also find that higher self-efficacy appears to reassure and compose learners who face challenging tasks whereas low self-efficacy invites students to emphasize errors and other information that handicaps performance. Research indicates that students with a strong sense of academic self-efficacy profit in several ways (Ogunnniyi et al, 2020). Students with a strong sense of self-efficacy seem to self-regulate more productively, more willingly take on challenging tasks, apply more effort, persist longer despite obstacles, experience less anxiety, use more effective tactics and strategies, achieve better academic performances, and cognitively process information more effectively (Ogunnniyi et al, 2020).

Also, Oyediran, et al (2022) report that mathematics self-efficacy was a significantly positive predictor of mathematics achievement in Nigerian secondary schools. Their findings suggest that students who were confident of their performance in mathematics tended to have better mathematics achievement. Students who have high mathematics self-

efficacy could understand well the most difficult material presented. They could do well on mathematics assignments and tests, and, more importantly, they could master the skills being taught in their mathematics classes, hence, they were more likely to have better mathematics achievement. Therefore, there is a need to improve students' self-efficacy which may improve students' mathematics achievement.

Not all researchers have found a significant relationship between efficacy beliefs and academic outcomes. Oyedotun (2022) discovers that Nigerian college students' self-assessment of mathematical ability was a stronger predictor of academic achievement (GPA) than self-efficacy. However, self-efficacy was measured using a global self-concept scale, which may not accurately capture context-specific efficacy beliefs. Similarly, Adeyemo (2022) finds that self-efficacy was a weak predictor of academic performance among Nigerian secondary school students, possibly due to the use of a general self-efficacy scale rather than a task-specific measure. Okoro (2020) notes that when efficacy beliefs do not align with the specific task or criteria, they are unlikely to be predictive of academic outcomes

Some researchers have reported a lack of relationship between mathematics self-efficacy and mathematics performance, but these studies often suffer from important conceptual and measurement flaws. Oyedotun (2022) finds that the relationship between mathematics self-efficacy and performance was significant, but only when self-efficacy was assessed with specific, context-dependent items (e.g., "I am confident in my ability to solve this mathematics problem"). In contrast, studies that use global, general items to assess self-efficacy (e.g., "I am good at mathematics") often find no significant relationship with performance (Adeyemo, 2022). Okoro (2020) noted that the relationship between mathematics self-efficacy and performance is complex and influenced by various factors, including prior experiences, social support, and cognitive styles. Therefore, more nuanced and context-specific measures of self-efficacy are needed to fully understand its relationship with mathematics performance.

Mathematics anxiety refers to the emotional responses and personal experiences that individuals develop towards learning mathematics. Negative feelings towards mathematics often arise from various encounters related to the presentation, teaching, and learning of mathematics (Adeyemo, 2022). According to Oyedotun (2022), mathematics anxiety is characterized by feelings of apprehension and tension that individuals experience when faced with mathematical problems. This anxiety can manifest physically, such as a rapid heartbeat, and cognitively, such as a lack of confidence in one's ability to solve mathematical problems (Okoro, 2020). Mathematics anxiety can become a debilitating condition, leading students to avoid mathematics altogether (Ajayi, 2022). In Nigerian contexts, mathematics anxiety has been found to interfere with students' ability to manipulate numbers and solve mathematical problems in various academic and everyday situations (Eze, 2022.

Mathematics anxiety is a pervasive issue affecting many individuals. Research has shown that it can have debilitating effects on college students, including feelings of nervous tension, fear of rejection, and stress (Adeyemo, 2022). According to Oyedotun (2022), mathematics anxiety can significantly impair students' performance, much like a novice golfer on the first tee, by fostering nervousness and insecurity towards mathematics. At the tertiary level, this anxiety is often most pronounced in mathematics courses required for non-technical majors (Okoro, 2020). Most mathematics educators concur that mathematics anxiety primarily stems from students' deep-seated fears of failure and feelings of inadequacy (Ajayi, 2022). Although mathematics anxiety may not always be extreme, it can persistently haunt students throughout their academic encounters with mathematics (Eze, 2022).

According to Oyedotun (2022), there are three primary causes of mathematics anxiety: beliefs, learning environment, and anticipatory response. These variables are interconnected and

reinforce one another. Beliefs may encompass negative stereotypes about one's gender, race, or ethnicity (Adeyemo, 2022). Research by Okoro (2020) suggests that cultural beliefs can contribute significantly to mathematics anxiety, particularly among female students. To address this issue, cognitive restructuring of beliefs and promoting positive self-talk can be beneficial (Ajayi, 2022).

Studies have shown that students propose various strategies to reduce mathematics anxiety. These include teachers providing study habits guidance, confidence-building measures, and hands-on activities (Eze, 2022). Also, students suggest that after-school tutoring, self-help programs, and relaxation techniques can help alleviate mathematics anxiety (Oyedotun, 2022). Teachers can also employ curricular and instructional strategies, such as retesting, self-paced learning, technology integration, and communication, to minimize mathematics anxiety (Okoro, 2020).

Mathematics anxiety has been found to impede working memory efficiency, as intrusive thoughts and worries divert focus away from mathematical tasks, leading to decreased logical thinking, increased errors, and prolonged processing times (Oyedotun, 2022). Research has shown that mathematics anxiety can have long-term consequences, including decreased competence, reduced completion rates, and lower academic performance in mathematics (Adeyemo, 2022). A study by Okoro (2020) finds a negative correlation between mathematics anxiety and performance, indicating that learners with higher levels of mathematics anxiety tend to have lower levels of performance in mathematics.

In Nigeria, mathematics education is crucial for national development and global competitiveness. However, mathematics anxiety remains a significant challenge, particularly among non-mathematics majors (Eze, 2022). Research has identified various factors contributing to poor performance in mathematics, including institution-related variables, teacher-related variables, home-related variables, and student-related variables (Ajayi, 2022).

Other available literatures have related students' inability to apply mathematics concepts, principles and skills in their respective courses of study to variables such as sex, self-concept, self-efficacy, and anxiety. As a result of these factors, this study, sought to investigate the extent to which students' sex, self-concept, self-efficacy and anxiety determine the performance of Non-mathematics majors in Southwestern Nigerian Universities. The outcome of this study with respect to the selected variable will significantly serve as a pointer to other future researchers. In the same way, the study provides knowledge and guidelines that may be of help to students, mathematics teachers/lecturers, parents, policy makers and the entire society at large in improving the above-mentioned students' mathematics performance. This will also serve as an insight for educational authorities in the country for better decision. More importantly, this study differs from related studies.

Hypotheses

The following research hypotheses were tested at 0.05 level of significance

H01: There is no significant joint and relative effect of self-concept and self-efficacy on performance of students in Mathematics in Southwestern Nigerian Universities.

H02: There is no significant joint and relative effect of self-concept and self-efficacy on performance of students in Mathematics based on gender in Southwestern Nigerian Universities.

H03: There is no significant joint and relative effect of self-efficacy and anxiety on performance of students in Mathematics in Southwestern Nigerian Universities.

H04: There is no significant joint and relative effect of self-efficacy and anxiety on performance of students in Mathematics based on gender in Southwestern Nigerian Universities.

Procedures

The study adopted ex-post facto research design. The population of the study consisted of all the final year students enrolled in Mathematics-related

courses in Universities located in Southwestern Nigerian. The sample of the study was selected using the multi-stage sampling technique. At the first stage, three states out of the six states in the Geo-political zone were selected using purposive sampling technique. At the second stage, six universities were selected based on the availability of the following seven academic programmes - Chemistry, Physics, Computer Science, Civil Engineering, Electronics/Electrical Engineering, Economics and Sociology in both the Federal and State Universities. At the third stage, final year regular undergraduate students consisting of 755 respondents altogether were selected using simple random sampling technique. In order to collect data and provide answers to the research hypotheses, the following instruments were developed and employed in gathering the data:

1. Student Biographic Data (SBGD): SBGD was used to elicit information on the biographical data of students on questions such as Name of Institution, Students' registration number, Level, Courses of study, Sex, Age and Grade scales obtained in WAEC/NECO used for gaining admission into their current institution
2. Mathematics Self-concept Scale (MSCS): MSCS was an adapted 14-items from Wigfield and Eccles (2000) used to elicit information among others on a) how good the participants think they are at Mathematics, b) how well they expect to do in the future in Mathematics, c) how good they will be at learning something new in Mathematics
3. Mathematics Self-efficacy Scale (MSES): MSES was an adopted 7-item from Midgley, Maehr, Hruda et al (2000) to elicit information on participants' belief or confidence in his ability to do Mathematics.
4. Mathematics Anxiety Questionnaire (MAQ): MAQ was an adapted 21-item from Fennema and Sherman (1977). This was used to elicit information on students' experience of anxiety in Mathematics.

The initial draft of the instruments was validated by giving them to experts in questionnaire and content construction for inputs. Thereafter, the items were modified along the lines suggested by the comments of these experts. Pilot testing of the instruments was also carried out by administering the instruments to fifty-four (54) students in the seven (7) selected Mathematics-related programmes in a University within the geo-political zone different from those selected for the study. The data collected showed that the students did not have problems responding to the items in the questionnaire.

Guttmann Split-half method was used to determine the reliability coefficients of the instruments. The scores for each item were encoded in STATA version 12 software. The Reliability coefficients of the instruments established as: MSCS = 0.63; MSES = 0.79 and MAQ = 0.82. The construct, content and criterion related validities were found to be adequate.

The data for the study were collected from students of selected universities in the Southwestern Nigeria. After data collection, any questionnaire response that could not match with a corresponding registration number in the students Mathematics course score sheets, as obtained from the record offices of their respective institutions was discarded. The idea was to have complete sets of the students' related instruments. 930 copies of the questionnaire were distributed to the selected students doing the 7 selected programmes in the selected 6 universities of the three selected states and a total of 755 questionnaires, fully responded to, were utilized. Data collected were analyzed using linear regression at 0.05 level of significance.

Results

H_{01}: There is no significant joint and relative effect of students' self-concept and self-efficacy on performance in Mathematics of undergraduates in Southwestern Nigerian Universities

Table 1: Joint and Relative Effects of Self-Concept (MSC) and Self-Efficacy (MSE) on Performance in Mathematics (PIM)

R^2	Adjusted R^2	F	p-value	PIM	Standardized coefficient	T	p-value
0.051	0.048	20.15	0.000	MSC MSE	-0.0811 0.1624	-1.83 6.22	0.068 0.000

H_{02}: There is no significant joint and relative effect of students' self-concept and self-efficacy on performance in Mathematics of undergraduates based on gender in Southwestern Nigerian Universities

Table 2: Joint and Relative Effects of Self-Concept (MSC) and Self-Efficacy (MSE) on Performance in Mathematics (PIM) based on Gender

Sex/N	R^2	Adjusted R^2	F	p-value	PIM	Standardized coefficient	T	p-value
Male/493	0.049	0.046	12.73	0.00	MSC MSE	-0.0349 0.2366	-0.69 4.72	0.489 0.000
Female/262	0.051	0.043	6.93	0.001	MSC MSE	-0.1352 0.2557	-1.97 3.72	0.50 0.000

H_{03}: There is no significant joint and relative effect of Mathematics self-efficacy and Mathematics anxiety on performance in Mathematics of undergraduates in Southwestern Nigerian Universities

Table 3: Joint and Relative Effects of Self-Efficacy (MSE) and Mathematics-Anxiety (MAX) on Performance of Students in Mathematics (PIM)

R^2	Adjusted R^2	F	p-value	PIM	Standardized coefficient	T	p-value
0.068	0.065	27.31	0.000	MAX MSE	-0.1458 0.2022	-4.12 5.72	0.000 0.000

H_{04}: There is no significant joint and relative effect of Mathematics self-efficacy and anxiety on performance in Mathematics of undergraduates based on gender in Southwestern Nigerian Universities

Table 4: Joint and Relative Effect of Mathematics self-efficacy (MSE) and anxiety (MAX) on performance of students in Mathematics (PIM) based on gender

Sex/N	R^2	Adjusted R^2	F	p-value	PIM	Standardized coefficient	T	p-value
Male/493	0.057	0.053	14.83	0.000	MSE MAX	0.1307 -0.0931	4.47 -2.12	0.000 0.035
Female/262	0.076	0.069	10.59	0.000	MSE MAX	0.1325 -0.1517	3.50 -3.30	0.001 0.001

Discussion of findings

In this study, the relationships among affective variable and performance of Nigerian undergraduate students as well as the influence of gender towards the selected variables and performance in Mathematics of the students were investigated. The result in table 1 revealed that R-value (0.051) has an adjusted R^2 (0.048, $p < 0.05$) in which both MSC and MSE accounted for 5.10% of the total variance in PIM. The F-value (20.15) which is significant at 0.05 ($p < 0.05$) with beta values -0.0811 for MSC and 0.1624 for MSE showed that MSC and MSE have significant joint effect on PIM. There is

an indication that a unit increase in student's MSC will lead to -0.0811 units decrease in PIM and a unit increase in student's MSE will lead to 0.1624 units increase in PIM. This showed that student's MSC and MSE have significant relative effects on PIM. Therefore, the null hypothesis that there is no significant joint and relative effect of MSC and MSE on PIM is rejected.

From table 2, the R-value (0.049) has an adjusted R^2 (0.046, $p < 0.05$) in which both MSC and MSE accounted for 4.60% of the total variance in the performance of male students in Mathematics. The F-value (12.73) which is significant at 0.05 ($p < 0.05$) with beta values -0.0349 for MSC and 0.2366 for MSE showed that male students' Mathematics self-concept and Mathematics self-efficacy have significant joint effect on PIM. There is an indication that for male students, a unit increase in student's MSC will lead to -0.0349 units decrease in PIM and a unit increase in student's MSE will lead to 0.2366 units increase in PIM. This showed that student's MSC and MSE have significant relative effects on PIM. In the same way, the table also revealed that R-value (0.05) has an adjusted R^2 (0.05, $p < 0.05$) in which both MSC and MSE accounted for 4.30% of the total variance in the performance of female students in Mathematics. The F-value (6.93) which is significant at 0.05 ($p<0.05$) with beta values -0.1352 for MSC and 0.2557 for MSE showed that female students' mathematics self-concept and mathematics self-efficacy have significant joint effect on performance in mathematics. There is an indication that for female students, a unit increase in student's MSC will lead to -0.1352 units decrease in PIM and a unit increase in student's MSE will lead to 0.2557 units increase in PIM. This showed that student's MSC and MSE have significant relative effects on PIM. Therefore, the null hypothesis that there is no significant joint and relative effect of self-concept and self-efficacy on performance of male and female students in Mathematics is rejected.

From table 3, it was revealed that R-value (0.068) has an adjusted R^2 (0.065, $p < 0.05$) in which both MSE and MAX accounted for 6.50% of the total variance in PIM. The F-value (27.31) which is significant at 0.05 ($p < 0.05$) with beta values 0.2022 for MSE and -0.1458 for MAX showed that MSE and MAX have significant joint effect on PIM. There is an indication that a unit increase in MSE will lead to 0.2022 units increase in PIM and a unit increase in student's MAX will lead to -0.1458 units decrease in PIM. This showed that the MSE and MAX have significant relative effects on PIM. Therefore, the null hypothesis that there is no significant joint and relative effect of MAX and MSE on PIM is rejected.

From table 4, the R-value (0.057) has an adjusted R^2 (0.053, $p < 0.05$) in which both MSE and MAX accounted for 5.70% of the total variance in the performance of male students in Mathematics. The F-value (14.83) which is significant at 0.05 ($p < 0.05$) with beta values -0.1307 for MSE and -0.0931 for MAX showed that male students' mathematics self-efficacy and mathematics anxiety have significant joint effect on PIM. There is an indication that for male students, a unit increase in student's MSE will lead to 0.1307 units increase in PIM and a unit increase in student's MAX will lead to -0.0931 units decrease in PIM. This showed that student's MSE and MAX have significant relative effects on PIM. In the same way, the table also revealed that R-value (0.076) has an adjusted R^2 (0.069, $p < 0.05$) in which both MSE and MAX accounted for 7.60% of the total variance in the performance of female students in Mathematics. The F-value (10.59) which is significant at 0.05 ($p<0.05$) with beta values 0.1325 for MSE and -0.1517 for MAX showed that female students' Mathematics self-efficacy and Mathematics anxiety have significant joint effect on performance in Mathematics. There is an indication that for female students, a unit increase in student's MSE will lead to 0.1325 units increase in PIM and a unit increase in student's MAX will lead to -0.1517 units decrease in PIM. This showed that student's MSE and MAX have significant relative effects on PIM. Therefore, the

null hypothesis that there is no significant joint and relative effect of students MSE and MAX on performance of male and female students in mathematics is then rejected. Notwithstanding, it is expected from theoretical viewpoint, that high and positive self-concept should match high performance in mathematics which is slightly lacking in the study.

Conclusions

Based on the findings of this study, it could be concluded that student's MSC and MSE have significant joint and relative effects on PIM, MSC and MSE have significant joint and relative effects on male and female PIM, MSE and MAX have significant joint and relative effects on PIM, and MSE and MAX have significant joint and relative effects on male and female PIM.

Recommendations

It is therefore recommended that:

(i) educators should design programs to improve students' MSC and MSE, as these variables have significant joint and relative effects on performance in mathematics (PIM).

(ii) educators should identify strategies to reduce MAX, as it has a significant negative impact on PIM.

(iii) educators should recognize the differences in MSC, MSE, and MAX between male and female students and adapt their teaching methods accordingly.

(iv) educators should incorporate practical activities and real-world examples to make mathematics more engaging and relevant, potentially enhancing MSC and MSE.

(v) educators should encourage students to view challenges as opportunities for growth, rather than threats to their ego, to promote a positive MSC and MSE.

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