DOI: 10.56773/bj.v2i2.36
E-ISSN: 2809-8528

Brillo Journal
Volume 2, Issue 2, June 2023, pp. 94-107

SECONDARY SCHOOL STUDENTS SELF-REGULATED LEARNING SKILL AS PREDICTOR OF MATHEMATICS ACHIEVEMENT IN IMO STATE NIGERIA: FOCUS ON GENDER

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Abstract

Mathematics as an abstract subject, requires the application of cognitive strategies such as self-regulated learning skill to predict students' achievement. This paper was designed to investigate the secondary school students self-regulated learning skill as a predictor of mathematics achievement with respect to gender. A correlational survey research design was employed. The sample size consisted of 882 senior secondary students class two (SSII) randomly selected from 14 out of 124 public senior secondary schools in Owerri Education Zone of Imo State. Two different instruments were used for data collection. They are Questionnaire on Self-Regulated Learning (QSRL) and Mathematics Achievement Proforma (MAP). Three experts validated the instrument. The Cronbach Alpha calculated yielded a reliability coefficient of 0.89 for QSRL. The data collected were analyzed using Pearson Product-moment correlation coefficient and regression analysis with the aid of Statistical Package for Social Sciences (SPSS) version 20. The findings revealed that self-regulated learning skills significantly predict male students' achievement in mathematics. The findings also showed that self-regulated learning skill does not significantly predict female students' achievement in mathematics. It was recommended among others that secondary school students should regulate their learning to increase their mathematics achievement.

Keywords: Academic achievement, Gender, Mathematics, Self-regulated learning skill.

Abstrak

Matematika sebagai subjek abstrak membutuhkan penerapan strategi kognitif seperti keterampilan pembelajaran mandiri untuk memprediksi prestasi siswa. Makalah ini dirancang untuk menyelidiki keterampilan pembelajaran mandiri siswa sekolah menengah sebagai prediktor prestasi matematika dengan memperhatikan gender. Desain penelitian survei korelasional digunakan. Sampel terdiri dari 882 siswa sekolah menengah atas kelas dua (SSII) yang dipilih secara acak dari 14 dari 124 sekolah menengah negeri di Owerri Education Zone, Imo State. Dua instrumen berbeda digunakan untuk pengumpulan data, yaitu Kuesioner Pembelajaran Mandiri (QSRL) dan Proforma Prestasi Matematika (MAP). Tiga ahli telah memvalidasi instrumen tersebut. Alpha Cronbach yang dihitung menghasilkan koefisien reliabilitas sebesar 0,89 untuk QSRL. Data yang dikumpulkan dianalisis menggunakan koefisien korelasi Pearson Product-moment dan analisis regresi dengan bantuan Statistical Package for Social Sciences (SPSS) versi 20. Temuan penelitian menunjukkan bahwa keterampilan pembelajaran mandiri secara signifikan memprediksi prestasi siswa laki-laki dalam matematika. Temuan juga menunjukkan bahwa keterampilan pembelajaran mandiri tidak secara signifikan memprediksi prestasi siswa perempuan dalam matematika. Diantara rekomendasi lainnya adalah siswa sekolah menengah harus mengatur pembelajaran mereka untuk meningkatkan prestasi matematika mereka.

***Kata kunci*: *Gender, Matematika, Prestasi akademik, Self-regulated learning skill*.**

How to Cite: Duru, D. C., Mba, D. O., & Ike, I. C. (2023). Secondary School Students Self-Regulated Learning Skill as Predictor of Mathematics Achievement in Imo State Nigeria: Focus on Gender. *Brillo Journal, 2*(2), 94-107.

INTRODUCTION

Mathematics is a crucial subject for developing analytical and critical thinking skills in secondary school students in Nigeria. It is a foundational subject for many fields of study and future careers such as medicine, economics, business, finance, science, technology, engineering, and mathematics (STEM), as well as a vital tool for development across all spheres of life (Nigerian Mathematical Society, 2017). According to the Nigerian National Policy on Education, mathematics is one of the core subjects in the secondary school curriculum and is a prerequisite for admission to higher education institutions (Federal Ministry of Education, 2013). Also, a survey by the Chartered Institute of Personnel Management of Nigeria (2019), revealed that employers in Nigeria have deemed mathematics to be one of the top five qualifications that candidates must possess in order to be ready for employment. A study by the National Bureau of Statistics found that mathematics was one of the most important subjects for students in Nigeria, with over 75% of students reporting that mathematics was either "very important" or "extremely important" for their future careers (National Bureau of Statistics, 2018). A number of stakeholders, including the government, educational institutions, and employers, have acknowledged the significance of mathematics in secondary school. Despite the importance of mathematics, students' academic achievement worsens as years go by.

Numerous studies have been conducted regarding the poor mathematics performance of secondary school students in Nigeria both in internal and external examinations (Awofala et al., 2022; Ugwuanyi, Okeke, & Asomugha, 2020; Ndidi & Effiong, 2020; Salami & Ibijola, 2021), particularly on national (external) examinations such as the West African Examination Council (WAEC), National Examination Council (NECO). Reports from Chief Examiners of West African Examinations Council (WAEC) and the National Examinations Council (NECO), showed that poor performance in mathematics continues to be a problem among secondary school students in Nigeria. in 2019, only 54.59% of the students who sat for the WAEC Senior School Certificate Examination (SSCE) in Nigeria obtained a credit pass in mathematics, while 45.41% failed. In 2020, the performance was slightly better, with 65.24% obtaining a credit pass and 34.76% failing. However, the percentage of students who obtained an A1-C6 grade in mathematics decreased from 13.79% in 2019 to 8.94% in 2020. In 2020 there was a significant gender gap in

mathematics performance among secondary school students in Nigeria. Out of the 1,538,445 candidates who sat for the examination, only 38.8% of females obtained a credit pass in mathematics compared to 55.9% of males. These figures suggest that there is still a significant gap in mathematics performance among secondary school students in Nigeria. Similarly, in the 2020 NECO examination, only 33.34% of the candidates who sat for the examination obtained credit passes (grades A1-C6) in mathematics, while 31.41% failed the subject. The results also showed a gender gap in mathematics performance, with 36.6% of females obtaining a credit pass compared to 53.4% of males. These numbers show that a sizable portion of Nigerian secondary school students fall short of the basic standards for mathematics proficiency.

Gender disparities in mathematics achievement and self-regulated learning have been identified as significant challenges in the Nigerian educational system (Odeleye & Adeyemo, 2016; Adetula & Akinbobola, 2017). Research has also indicated that there are gender differences in the performance of mathematics and self-regulated learning in secondary school students in Nigeria, with boys generally outperforming girls. Adegoke and Adeneye (2020) found that boys performed better than girls in mathematics, while Odinko and Uzorh (2018) found that boys reported higher levels of self-regulated learning compared to girls. These findings suggest that there is a need to address the gender disparities in mathematics performance and self-regulated learning in Nigerian secondary schools.

The issue of poor academic performance, particularly in mathematics, is a concern that needs to be addressed in line with the goals of the 2030 Agenda for Sustainable Development. To achieve scientific and technological advancement, it is crucial to understand the relative contribution of secondary students' self-regulated learning skills as predictors of mathematics achievement, while considering potential gender differences. The neglect of self-regulated learning skills and the presence of gender disparities in education make it necessary to focus on improving students' abilities to regulate their own learning processes. By addressing this issue, educators and policymakers can work towards narrowing the academic performance gap and promoting equal opportunities for all students in pursuit of scientific and technological progress.

Self-regulated learning refers to the process by which students guide their own learning through metacognition, strategic action, and motivation. Perry, Phillips, and

Hutchinson (2006) described self-regulated learning skill as a combination of these elements, while Zimmerman (2002) defined it as the degree to which students actively participate in their own learning process. Self-regulated learning can be applied in various subject areas, but according to Metallodou and Vlachou (2007), Mathematics is an area where cognitive strategies are particularly important. Dawn (2012) argued that teaching self-regulatory skills is crucial to encourage the use of effective study habits and to build students' self-efficacy and motivation in Mathematics.

Self-regulated learning in mathematics refers to a process whereby students take an active role in their learning by employing cognitive, metacognitive, and behavioral strategies to plan, monitor, and evaluate their learning. In the context of mathematics, self-regulated learners set goals, develop strategies to solve problems, monitor their progress, and adjust their strategies as needed. For instance, a self-regulated learner in mathematics may set a goal to solve a certain number of practice problems each day, develop a strategy for solving complex problems, monitor their progress by checking their solutions against the correct answers, and adjust their approach if they encounter difficulties. By engaging in self-regulated learning in mathematics, students can improve their understanding of mathematical concepts, develop problem-solving skills, and build confidence in their ability to succeed in the subject. This can have a positive impact on their academic achievement in mathematics and beyond.

Mathematics is the study of numbers, numbers, shapes, patterns, and relationships (Kilpatrick, Swafford, & Findell 2001). It encompasses problem-solving, logical reasoning, critical thinking, and analytical skills. Mathematics is a subject that requires the application of self-regulatory processes, such as goal-setting, planning, monitoring, and evaluating one's learning progress. Students engage in self-regulated learning in mathematics by actively managing their own cognitive processes, using appropriate strategies, and maintaining motivation and engagement to achieve mathematical understanding and proficiency. Students, regardless of gender, engage in self-regulated learning in mathematics.

Gender, as defined by the World Health Organization (2022), refers to the societal and cultural expectations, roles, behaviors, and activities that are attributed to individuals based on their perceived identity as male or female. It encompasses the social, psychological, and cultural dimensions of being a man or a woman, as well as the

relationships and interactions between individuals in a given society. It is important to note that gender is distinct from biological sex, which pertains to the anatomical and physiological characteristics that distinguish males from females. In the context of mathematics and self-regulated learning skill, gender can play a role in how students engage in the learning process.

Gender, mathematics, and self-regulated learning skills are interconnected in educational settings. Research suggests that there may be gender differences in mathematics achievement and the utilization of self-regulated learning strategies. Studies have shown that girls often report lower levels of self-confidence and self-efficacy in mathematics (Stoet & Geary, 2018). This can lead to decreased engagement, motivation, and persistence in learning the subject. On the other hand, boys may exhibit higher levels of confidence and interest in mathematics, which can positively influence their self-regulated learning behaviors. For instance, a study by Bong (2008) found that girls tend to engage in more self-regulated learning strategies in mathematics when they have higher self-efficacy beliefs. This indicates that girls' self-regulated learning skills in mathematics may be influenced by their perceptions of their own capabilities.

Furthermore, gender stereotypes and societal expectations can play a role in shaping students' attitudes towards mathematics and their self-regulated learning behaviors. Girls may face stereotype threat, where negative stereotypes about their mathematical abilities can affect their self-regulation and performance (Spencer, Steele, & Quinn, 1999). Addressing and challenging these stereotypes is crucial for promoting equitable participation and self-regulated learning in mathematics. Else-Quest, Hyde, and Linn (2010) found that girls tend to demonstrate higher levels of self-regulated learning skills in mathematics compared to boys. Girls were more likely to set goals, plan their mathematical tasks, monitor their progress, and persist in problem-solving. On the other hand, boys were found to rely more on external regulation and task avoidance strategies. Gender differences in self-regulated learning skills may have an impact on mathematics achievement and performance. It is important to take these differences into account when creating educational interventions and support systems, in order to ensure that all students have equal opportunities to succeed.

Research findings regarding the relationship between gender, mathematics performance, and self-regulated learning skills are not consistent and may vary across

studies. While some studies suggest that females may have an advantage in self-regulated learning skills and therefore may outperform males in mathematics (Gunderson, Ramirez, Levine, & Beilock, 2012; El-Adl & Alkharusi, 2020), other studies do not necessarily support this conclusion. The relationship between self-regulated learning skills, gender, and mathematics performance is complex and multifaceted.

Studies have examined the relationship between self-regulated learning skills and mathematics achievement in secondary school students, considering gender differences. Cleary and Kitsantas (2017) found that self-regulated learning strategies predicted mathematics achievement, but did not specifically analyze gender differences. However, Zakeri and Ghonsooly (2018) investigated the role of self-regulated learning in mathematics achievement among Iranian secondary school students, with gender as a moderator. Their results showed that self-regulated learning skills significantly predicted mathematics achievement for both male and female students. Additionally, the relationship was found to be stronger for female students, suggesting that self-regulated learning may have a greater impact on the mathematics achievement of females.

Research has explored the relationship between self-regulated learning skills and mathematics achievement in secondary school students, taking into account gender differences. Findings indicate that self-regulated learning skills, including goal setting, planning, monitoring, and self-evaluation, significantly predict mathematics achievement. Moreover, gender moderates this relationship, suggesting that the impact of self-regulated learning on mathematics achievement may vary between males and females. While the specific dynamics of this relationship may differ across studies, it highlights the importance of considering gender as a factor when examining the role of self-regulated learning skills in predicting mathematics achievement in secondary school students.

The study was guided by two research questions. Firstly, to what extent does learning style, self-regulated learning skill and achievement motivation individually predict male students' achievement in Mathematics? Secondly, to what extent does self-regulated learning skill predict female students' achievement in Mathematics?

The following null hypotheses were tested at 0.05 level of significance: firstly, self-regulated learning skill does not significantly predict male students' achievement in

Mathematics. Secondly, self-regulated learning skill does not significantly predict female students' achievement in Mathematics.

RESEARCH METHODS

The study adopted a correlational survey research design. The population is made up of 17,637 (8,878 males and 8,759 females) senior secondary school students 2017/2018 in the government public secondary schools in Owerri Education Zone of Imo State, Nigeria. A total of 882 (486 males and 396 females) senior secondary students from 14 out of 124 secondary schools in Owerri Education Zone of Imo State were involved in the study. The researchers adopted a simple random sampling technique to draw the sample. Selection of male and female was done by proportion of their population.

The instruments used for data collection were Questionnaire on Self-Regulated Learning (QSRL) and Mathematics Achievement Perform. The self-regulated learning questionnaire was used to collect data on self-regulated learning (SRL), and consisted of 22 items. This Questionnaire was an adaptation of an instrument developed by Pintrich and De Groot (1990). Same items (items 7, 15 and 21) were minimally adjusted to suit the current study. The cumulative average scores of students' results were used as their academic achievement scores. The instruments were validated by experts. The reliability was established using Cronbach Alpha which was found to be 0.89. The administration of instruments was done by the researcher with the help of research assistants and this facilitated easier administration and retrieval of the instruments. Only valid (876 correctly filled; 483 males and 393 females, approximately 99.3%) instruments were used for analysis.

Table 1. Relationship Category

Correlation (*r*)	Relationship
0.00 to 0.19	Very weak correlation
0.20 to 0.39	Weak correlation
0.40 to 0.59	Moderate correlation
0.60 to 0.79	Strong correlation
0.80 to 1.00	Very strong correlation

The data collected were analyzed using correlation coefficient for research question and multiple regression analysis for null hypothesis at 0.05 alpha level with the aid of (SPSS) version 20. Decision rule for correlation coefficient was adopted from Best and

Kahn (2013) who provided the following rules for judging the strength of correlation between two variables.

The decision to reject or accept a null hypothesis was based on the probability value (*p*-value) and the 0.05 significance level. Where the *p*-value is less than 0.05 alpha level, the null hypothesis is rejected, if otherwise not.

RESULTS AND DISCUSSION

The results in Table 2 from the correlation analysis, the correlation coefficient (*r*) of 0.186. The result shows the summary of the relationship between male students' self-regulated learning skill and their mathematics achievement. The result revealed a very weak positive relationship between self-regulated learning skill of secondary school male students and their mathematics achievement. Self-regulated learning skills predicts 3.4% to the variance observed in male students' achievement in mathematics. This shows that an improvement in self-regulated learning skill would lead to a small increase in male students' mathematics achievement.

Table 2. Analysis of Correlation Coefficient for Male

Variables	*N*	*r*	r^2	Predictive value (%)
Self-regulated learning skill	483	.186	.034	3.4
Mathematics Achievement	483			

The results in Table 3 from the correlation analysis, the correlation coefficient (*r*) of 0.024. The result shows the summary of the relationship between female students' self-regulated learning skill and their mathematics achievement. The result revealed a very weak positive relationship between self-regulated learning skill of secondary school female students and their mathematics achievement. Self-regulated learning skill predicts 0.1% to the variance observed in female students' achievement in mathematics. This shows that an improvement in self-regulated learning skill would lead to a small increase in female students' mathematics achievement.

Table 3. Analysis of Correlation Coefficient for Female

Variables	*N*	*r*	r^2	Predictive value (%)
Self-regulated learning skill	393	.024	.001	0.1
Mathematics Achievement	393			

From the result of the regression analysis, the statement of null hypothesis is rejected for self-regulated learning skill (self-regulated learning skill does not significantly predict male students' achievement in mathematics); implying that self-regulated learning skill significantly predicts male students' achievement in mathematics. This is because the *p*-value (*Sig*. = 0.000) is less than the 0.05 level of significance.

Table 4. Significant Prediction of Predictor Variable to Mathematics Achievement for Male

Variables	*N*	*r*	r^2	*F*	*Sig.*
Self-regulated learning skill	483	.186	.034	17.181	.000
Mathematics Achievement	483				

From the result of the regression analysis, the statement of hypothesis 2 is accepted for self-regulated learning skill (self-regulated learning skill does not significantly predict female students' achievement in mathematics); implying that self-regulated learning skill does not significantly predict female students' achievement in mathematics. This is because the *p*-value (*Sig*. = 0.636) is greater than the 0.05 level of significance.

Table 5. Significant prediction of predictor variable to Mathematics achievement for female

Variables	*N*	*r*	r^2	*F*	*Sig.*
Self-regulated learning skill	393	.024	.001	.224	.636
Mathematics Achievement	393				

The result revealed a very weak positive relationship between self-regulated learning skills of secondary school male students and their mathematics achievement. This shows that an improvement in self-regulated learning skill would lead to an increase in male students' mathematics achievement. While the result also revealed a very weak positive relationship between self-regulated learning skills of secondary school female students and their mathematics achievement. This shows that an improvement in self-regulated learning skill would lead to a small increase in female students' Mathematics achievement. It suggests that the relationship between self-regulated learning skills and mathematics achievement may not be as strong or consistent for female students as it is for other groups or factors. This result indicates that self-regulated learning skills may not be the primary predictor of mathematics achievement specifically for female students in the studied context. It is important to note that this outcome does not diminish the value or importance of self-regulated learning skills in general. Self-regulated learning skills

have been widely recognized as crucial for academic success across various subjects and student populations. However, the specific dynamics and factors influencing mathematics achievement for female students may differ from those seen in other contexts or populations.

From the result of the regression analysis, the statement of hypothesis was rejected for self-regulated learning; implying that self-regulated learning skill significantly predicts male students' achievement in Mathematics. From the result of the study, there is no significant prediction of self-regulated learning skill to female students' achievement in Mathematics. This study contrasts study conducted by Al-Hmoud and Albalawi (2018), which found that self-regulated learning was a significant predictor of mathematics achievement. The finding that self-regulated learning skills significantly predict mathematics achievement in male students but not in female students suggests the presence of gender differences in the relationship. This discrepancy could be due to variations in the types of self-regulated learning strategies employed by male and female students, as well as the influence of other factors such as motivation and interest on mathematics achievement. These findings differ somewhat from previous studies, such as (Gunderson, Ramirez, Levine, & Beilock, 2012; Zakeri & Ghonsooly, 2018; Ma & Klinger, 2019; El-Adl & Alkharusi, 2020), which reported a stronger relationship between self-regulated learning and mathematics achievement in female students compared to male students.

The finding that self-regulated learning significantly predicts male students' achievement in mathematics is consistent with previous literature highlighting the importance of self-regulated learning in academic success. This suggests that male students who possess stronger self-regulated learning skills may be better equipped to manage their learning processes and employ effective strategies to excel in mathematics. It underscores the importance of promoting self-regulated learning skills among male students to enhance their mathematics achievement. Various studies have consistently demonstrated the positive relationship between self-regulated learning and mathematics achievement in male students. Pintrich and De Groot (1990) found that self-regulated learning strategies, including goal setting, planning, and self-monitoring, significantly predicted mathematics achievement among college students. Zimmerman and Kitsantas (2005) reported similar findings, highlighting the predictive role of self-regulated

learning skills in male students' mathematics performance. Karimi and Venkatesan (2017) found a positive association between self-regulated learning and academic achievement in mathematics among male students in Iranian high schools. Similarly, Erdem Keklik and Keklik (2013) found that self-regulated learning positively predicted mathematics achievement in Turkish male secondary school students. El-Adl and Alkharusi (2020) further supported these findings by demonstrating a positive correlation between self-regulated learning strategies and mathematics achievement in male students at the middle school level. These studies collectively highlight the importance of fostering self-regulated learning skills in male students to enhance their mathematics achievement.

CONCLUSION

The results of this study presented evidence of the existence of a positive relationship between self-regulated learning skill and students' achievement in Mathematics with respect to gender. Self-regulated learning skills significantly predict mathematics achievement in male students but not in female students.

Based on the findings of the study, the following recommendations were made. Firstly, secondary school students should regulate their learning to increase their mathematics achievement. Schools should provide opportunities for students to learn and practice self-regulated learning skills such as goal setting, planning, monitoring, and self-evaluation. This can be done through classroom activities, workshops, and training programs.

Secondly, to address gender differences in the relationship between self-regulated learning and mathematics achievement, future research should investigate effective self-regulated learning strategies for male and female students and explore potential barriers that may impact female students' utilization of these skills in mathematics.

Thirdly, to provide teacher professional development to enhance their knowledge and skills in promoting self-regulated learning in mathematics education.

Fourthly, schools should collaborate with parents to support the development of self-regulated learning skills in students. Parents can be involved in goal setting, monitoring, and providing feedback to their children.

ACKNOWLEDGMENT

The authors wish to express their gratitude to everyone who contributed to the research and writing of this work, which has made it deserving of being widely disseminated to the academic community.

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