Self-Regulation Ability as a Correlate of Secondary School Students' Academic Achievement in Biology in Anambra State

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Abstract

The unending quest to enhance students' academic performance in biology in external examinations motivated the study on relationship between self-regulation ability and secondary school students' academic achievement in biology. The study guided by three research questions, with three testable null hypotheses, adopted a correlational survey research design. Multi-stage sampling procedure was employed to draw a sample of 227 (94 males and 133 females) SS2 students, from the 18,730 SS2 students, enrolled in the 2023/2024 academic session in Anambra State. An Adapted Self-regulation scale (SRS) and a Biology score proforma (BSP), were used for data collection. SRS was face validated by three experts with a reliability co-efficient of 0.85 established using Cronbach alpha. Data collected were analyzed using Pearson Product Moment Coefficient to answer the research questions and t-test for correlation to test the null hypotheses at 0.05 alpha level. The findings of the study revealed that secondary school students' self-regulation ability positively and significantly correlated with their academic achievement in biology. Also, the study reported that male students were significantly more self-regulated than the female students, although the correlation was statistically significant for both. Based on the findings, the study concluded that students' self-regulation ability, irrespective of gender, has a strong relationship with their academic achievement in biology. The study therefore recommended among others that curriculum developers should redesign the biology curriculum to inculcate activities that will motivate students to think critically, promote self-determination and foster self-regulation abilities that will in the long run enhance their academic achievement in biology.

Keywords: Academic Achievement, Biology, Secondary School Students, Self-Regulation Ability

Introduction

Biology, a science subject, taught in Nigerian secondary schools, has been recognized as a tool for individual wealth creation and national development hinging on its applications in the fields of medicine, agriculture, pest and disease control, natural resource management as well as in environmental pollution control and management. Nwuba, et al. (2024a) defined biology as a branch of science that studies life and its forms. It is a branch of science structured to equip students with the knowledge of relevant concepts and scientific skills, allowing students to interact with a broad variety of living species as well as their local and wider surroundings (Eyamekware, &

Oyovwi, 2023). Hence, biology may simply be referred to as a pure science subject that studies life, its attributes and processes. Comprehending the definitions, one can categorically affirm that the importance of biology cannot be overestimated as students who study biology are made more aware of both their own health and significant biological issues including the usage of antibiotics, genetically modified foods, and eradicating invasive species. Supporting the premise, Okoye and Onwuachu (2018) argued that some major achievements of biological research include development of vaccines and drugs for preventing and curing of many serious diseases, organ transplant, In-vitro fertilizations (IVF) which helps infertile couple to have children, and production of hybrid plants and farm animals with desirable qualities.

Taking cognizance of the benefits of biology as well as its nature of little or no mathematical calculations, Nwuba, et al. (2024a) asserted that students' love the subject and often stereotype it as simple, evidently shown by the high population of enrollment in the subject in external examinations such as WASSCE by both science and art inclined students. Considering the premise, it is then expected that students' performance in the subject in external examinations will always be positively consistent, but the reverse has always been the case as seen in WAEC statistics report for biology from 2019-2023. That is, for 2019, for aggregate of A1-C6, a percentage pass of 55.63% was recorded, 63.23% in 2020, 58.09% in 2021, 64.16% in 2022 and 54.69% in 2023. In light of the statistics, many variables have been identified as responsible for the unsatisfactory/inconsistent poor achievement of students in biology. For instance, Onu et al. (2020) highlighted shortage of interest in biology, lack of functional biology laboratories, poor grasp of biological concepts and terminologies, gender dimensions/differences, socio-economic status, shortage/inadequate number of teachers and learning materials, students' attitudes towards biology, and teaching strategy adopted by biology teachers as factors influencing students achievement in biology. In concurrence with the premise, Nwuba, et al. (2024b) agreed that the effective teaching and learning of biology are marred by both environmental and personal factors, but however argued that there is a need to place students' personal variables first, considering the bulky nature of the biology curriculum, since these personal variables at a high extent drive motivation, interest, and wellbeing, that may influence academic achievement among students. Considering the premise, the researcher was motivated to investigate self-regulation ability, a student personal variable, and how it relates to their academic achievement in biology.

Self-regulation ability simply refers to an individual's capabilities and strategies to regulate one's emotions, behaviors, and cognition in order to achieve a setting goal. Matric (2018) defined it as one's ability to direct goals and ideas which can come from personal desires or the expectations of others, and help them adjust to the demands of society and environment. In academic context, self-regulation ability entails the adaptive regulation of cognitive, motivational, and affective processes to optimize learning (Winnie, 2017). Hence, self-regulation ability may simply be explained as a student's ability to set his/her goals for learning, make plans to achieve the set goals, and monitor progress to the attain of the set goals. In education today, self-regulation ability has been recognized as a major contributor to academic success, since it involves a meta-cognitive, motivational, and emotional processes of planning, monitoring, and adjusting resources for enhanced learning outcomes (Greene, 2018). Supporting the premise, Oates (2019) argued that when learners control their own learning, they are given opportunity to understand how they learn, their learning styles, and how they process information, which helps them understand themselves better in relation to their learning and the strategies that work best for them. Self-regulation ability helps learners familiarize and know how to apply series of cognitive strategies (rehearsal, elaboration, organization) in attending, transforming, organizing, elaborating and recovering information that helps them in planning, controlling and directing their mental processes towards achievement of academic goals (Nnaji &Okoli, 2019).

Considering these benefits of self-regulation ability, many research works have been carried to ascertain its influence on and relation to learning outcomes. For instance, Olakanmi and Gumbo (2017), Suan (2023) and Agiande et al. (2024) in their respective studies asserted that self-regulation significantly influenced students' academic success and achievement as it is connected to an individual's ability to consciously channel his or her efforts toward achieving a set goal. Nnaji and Okoli (2019), in their study, reported that students' self-regulation ability significantly and positively correlates with their academic achievement in physics, recommending that efforts should be made in schools to foster acquisition of self-regulation skills. In another study, Duru and Okeke (2019), revealed that students' self-regulation ability significantly predicted their academic achievement in mathematics by a variance of 1%, revealing that high self-regulated learners show greater efforts in monitoring and controlling academic tasks, classroom environment and the learning process aimed at avoiding external and internal distractions to maintain concentration to enhance academic achievement.

Academic achievement is a performance result that shows how well a person performed in relation to particular objectives that were the focus of activities in instructional environments. It is a measurable index that depicts a student's cognitive, affective and psychomotor domains in educational settings (Okeke and Samuel, 2022). In any academic settings, academic achievement has been identified as one of the main factors considered while evaluating a student's progress in as it helps the teacher evaluate his teaching and methodology. In the same vein, Lapaam, et al. (2024) noted that academic achievement of students is the center around which the whole education system revolves, as it is the key to measuring the success and failure of any educational institution. At the secondary school level, Nwuba, et al. (2023) posited that academic achievement is synonymous to success as schools and parents believe that better academic results may lead to better career options and future security, irrespective of gender.

Gender refers to the biological characteristics of being a boy or a girl. According to Mkpa et al. (2020), it refers to the socially constructed characteristics of women and men such as norms, roles and relationships of and between groups of women and men. In recent times, Obikezie et al. (2025) asserted that understanding of gender has evolved, recognizing that it exists beyond a binary system and can include non-binary and gender queer identities, linking it to a deeply personal aspect that may align with a person's sex assigned at birth or differ from it, as seen in transgender individuals. In science education, gender differences in relation to its influence on students' personal variables and learning outcomes has remained a complicated issue. For instance, on studies on self-regulation ability of students, Nnaji and Okoli (2019) revealed that a low positive relationship exists between self-regulation ability of male and female students and their academic achievement in physics, although the relationship proved significant for the males and not for the females. In another study, Uche et al (2022) revealed that females achieved higher than their male counterparts, when both are taught biology using self-regulated learning, indicating that female students have higher self-regulation ability than males. Considering these findings on self-regulation ability as well as that on gender influence, we were motivated to investigate the relationship between secondary school students' self-regulation ability and their academic achievement in biology, employing gender as a moderating variable.

Research Questions

The following research questions were formulated to guide the study:

1. What is the relationship between students' self-regulation ability and their academic achievement in biology?
2. What is the relationship between male students' self-regulation ability and their academic achievement in biology?
3. What is the relationship between female students' self-regulation ability on their academic achievement in biology?

Hypotheses

1. Secondary school students' self-regulation ability does not significantly correlate with their academic achievement in biology.
2. Male secondary school students' self-regulation ability does not significantly correlate with their academic achievement in biology.
3. Female secondary school students' self-regulation ability does not significantly correlate with their academic achievement in biology

Methods

The study adopted a correlational survey research design. The sample comprised 227 (94 males and 133 females) SS2 students drawn from the 18,730 SS2 students in the 266-government owned secondary schools in Anambra State, in the 2023/2024 academic session. Multi-stage sampling procedure was employed to select the students from three, out of the six education zones, in the state: Aguata (51), Awka (94) and Onitsha (82). Two instruments: Self-Regulation Scale (BSRS) adapted from Lindner et al (1996) self-regulatory inventory and Biology Score Proforma (BSP) were used for data collection. Adapted BSRS is a 30 multiple choice items designed under a Five-point response options of Strongly Agree (SA), Agree (A), Undecided (UN), Disagree(D) and Strongly Disagree (SD) while BSP is a record spreadsheet of SS2 biology students obtained from the cumulative average for their 1st, 2nd and 3rd term biology examinations for the 2023/2024 academic session. BSRS was face validated by three experts with a reliability coefficient of 0.85 established using Cronbach Alpha. Data collected through face-to-face administration were analyzed using Pearson Product Moment Coefficient (r) to answer the research questions and t-test for correlation, to test the null hypotheses at 0.05 alpha levels. The interpretation of the relationship (r), in the research questions, was based on a 5-way guide illustrated as follows: r = .00 no relationship, r = ±.01 to ± 0.20 low relationship; r = ±.21 to ± 0.50 slight to fair relationship; r = ±.51 to ± 0.70 substantial relationship; r = ±.71 to ± 0.99 high relationship and r = ±1.00

perfect relationship. In testing the null hypotheses, reject the null hypotheses if the probability value (P-value) is less than 0.05 alpha level, if otherwise do not reject.

Results

Research Question one: What is the relationship between students' self-regulation ability and their academic achievement in biology?

Table 1: Pearson r on secondary school students' self-regulation ability and their academic achievement scores in Biology

Source of variation	N	r	Remark
Self-Regulation Ability/ Achievement	227	0.40	Slight to fair positive relationship

Data in Table 1 shows a Pearson coefficient (r) of 0.40 indicating that a slight to fair positive relationship exists between secondary school students' self-regulation ability and their academic achievement in biology, indicating that as students' self-regulation ability increases, their academic achievement also increases slightly.

Research Question Two: What is the relationship between male students' self-regulation ability and their academic achievement in biology?

Table 2: Pearson r on male secondary school students' self-regulation ability and their academic achievement scores in Biology

Source of variation	N	r	Remark
Self-Regulation Ability/ Achievement	94	0.49	Slight to fair positive relationship

Table 2 shows a Pearson coefficient (r) of 0.49 which indicates that a slight to fair positive relationship exists between male secondary school students' self-regulation ability and their academic achievement in biology. This also implies that as male students' self-regulation ability enhances, their academic achievement follows suit.

Research Question 3: What is the relationship between female students' self-regulation ability on their academic achievement in biology?

Table 2: Pearson r on female secondary school students' self-regulation ability and their academic achievement scores in Biology

Source of variation	N	R	Remark
Self-Regulation Ability/ Achievement	133	0.30	Slight to fair positive relationship

Pearson coefficient (r) of 0.30 obtained in table 3 indicates that a slight to fair positive relationship exists between female students' self-regulation ability and their academic achievement in biology, implying as female students' self-regulation ability improves, their academic achievement slightly improves too.

Null Hypothesis One: Secondary school students' self-regulation ability does not significantly correlate with their academic achievement in biology.

Table 4: T-Test for correlation between secondary school students' self-regulation ability and their academic achievement scores in Biology

Source of variation	N	P-Value	Decision
Self-Regulation Ability/ Achievement	227	0.00	Significant Relationship

Result in table 4 reveals that a strong association exists between secondary school students' academic achievement in biology and their ability to self-regulate. The null hypothesis is rejected since the p-value (0.00) is lower than the alpha (0.05) value. This demonstrates that there is a significant correlation between secondary school students' self-regulation ability and their academic achievement in biology.

Null Hypothesis Two: Male secondary school students' self-regulation ability does not significantly correlate with their academic achievement in biology.

Table 5: T-Test for correlation between male secondary school students' self-regulation ability and their academic achievement scores in Biology

Source of variation	N	P-Value	Decision
Self-Regulation Ability/ Achievement	94	0.00	Significant Relationship

Table 5 reveals that a significant statistical relationship exists between male secondary school students' self-regulation ability and their academic achievement in biology. The null hypothesis is rejected since the p-value (0.00) is lesser than the alpha level (0.05), revealing that male students' self-regulation ability has a strong relationship with their academic achievement in biology.

Null Hypothesis Three: Female secondary school students' self-regulation ability does not significantly correlate with their academic achievement in biology

Table 6: T-Test for correlation between male secondary school students' self-regulation ability and their academic achievement scores in Biology

Source of variation	N	P-Value	Decision
Self-Regulation Ability/ Achievement	133	0.00	Significant Relationship

The result presented in Table 5. revealed that the P-value (0.00) is less than the alpha level (0.05). Hence, the null hypothesis is rejected, showing that a significant relationship exists between female secondary school students' self-regulation ability and their academic achievement in Biology.

Discussion

The study revealed that a slight to fair positive relationship exists between secondary school students' self-regulation ability and their academic achievement in biology, implying that as students' self-regulation ability increases, their academic achievement increases. This finding was substantiated by the test of the null hypothesis in table 4. This significant positive relationship between the two constructs may be attributed to students' ability to self-regulate, as when cultivated in students helps them act independently, think critically, take responsibility for themselves, set goals, determine appropriate methods to reach these goals, become active in the learning process, and have the ability to self-assess their capability. The findings lend credence to that of Barut and Yüce (2025), Duru and Okeke (2019) and Nnaji and Okoli, (2019) who reported in their respective studies that, although weak, self-regulation ability significantly correlates with students' academic achievement positively. The study also agrees with the finding of Sahranavard et al. (2018) on their study in public university, but however disagrees with their finding in private university students. That is, while self-regulation ability significantly correlates with public university students' educational performance, it does not significantly correlate with that of private university students. Similarly, the findings of study concur with that of Agiande et al. (2024), Olakanmi and Gumbo (2017), and Suan (2023) who reported in their respective studies that self-regulation positively and significantly influenced students' academic achievement as it is connected to an individual's ability to consciously channel his or her efforts toward achieving a set goal and thus, linked to students' academic success and achievement.

On gender, the study revealed that a slight to fair positive relationship exists for both male and female, even though males seen to be more regulated than the females. The relationship, irrespective of gender, proved statistically significant when tested, revealing that both males and female students' have equal abilities to self-regulate. The findings concur with that of Agiande et al. (2024) but however agrees and somehow, contradicts with the findings of Nnaji and Okoli (2019) who reported that although a low positive relationship exist between male and female students' self-regulation ability and their academic achievement, the relationship proved statistically significant for the males and not for the females.

Conclusion

The quest to enhance academic achievement in a 21st century classroom has just gone beyond teachers merely passing knowledge to learners, but learners also being able to self-regulate

themselves to know their capability and work towards the betterment of themselves. Based on the findings, the study concluded that a significant positive correlation (relationship) exists between secondary school students' self-regulation ability and their academic achievement in biology irrespective of gender. That is, as students self-regulation ability is fostered, their academic achievement positively increases.

Recommendations

In the light of the findings of the study, the following recommendations were made:

1. Curriculum developers should redesign the biology curriculum to inculcate activities that will motivate students to think critically and foster self-regulation abilities that will in the long run enhance their academic achievement in biology
2. Parents should help cultivate high self-regulation strategies in their children at the early stages of their lives. This could be best done at home which is the most important social force in shaping and maintaining the child's self-learning.
3. Self-regulation strategy training workshops, seminars and conferences should be organized for biology teachers by the government, professional bodies and other educational stakeholders to educate teachers on approaches, techniques and strategies to employ during biology classes to help students cultivate self-regulation abilities.
4. School administrators should expose students to regular counselling session with specialists attending to their academic needs. Through these sessions, students encountering difficulties with self-regulation could be guided appropriately which will in turn positively impact on their academic achievement.

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