



ACADEMIC SELF-CONCEPT AND LOCUS OF CONTROL AS PREDICTORS OF SECONDARY SCHOOL STUDENTS' ACHIEVEMENT IN BIOLOGY IN AGUATA EDUCATION ZONE

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Abstract

The extent to which academic self-concept and locus of control predict secondary school students' academic achievement in Biology in Aguata Education Zone of Anambra State was investigated. Five research questions and five hypotheses guided the study. The study adopted a predictive correlational research design. The population of the study comprised 1,321 Senior Secondary School Two (SS2) students from the 24 government-owned secondary schools in Aguata Education Zone, Anambra State who registered for the Senior Secondary Certificate Examination (SSCE) Biology examinations in 2025/2026 academic session, with a sample of 437 SS2 Biology students estimated using a multistage sampling procedure. The instruments for data collection were Students' Academic Self-Concept in Biology Questionnaire (SASCBQ) and Students' Academic Locus of Control Questionnaire (SALCQ). The instruments were face-validated by three experts, and their reliability indices were 0.82 for SASCBQ and .86 for SALCQ, estimated using the Cronbach's Alpha Method. The data collected were analyzed using Ordinary Least Squares in the Statistical Package for the Social Sciences (SPSS). The data collected were analyzed using simple and multiple regression analysis. Specifically, the null hypotheses were tested using regression t-test of significance and regression Analysis of Variance (ANOVA) at 0.05 alpha level. Findings, among others, revealed that academic self-concept and locus of control had positive predictive power for students' academic achievement in Biology; academic self-concept and academic locus of control jointly and significantly predicted students' academic achievement in Biology. Based on the findings, it was recommended, among other things, that Biology teachers adopt teaching methods and classroom practices to help students develop a positive academic self-concept in Biology. Also, teachers should encourage students, provide positive reinforcement, and create supportive learning environments that build students' confidence and interest in Biology learning.

Keywords: Academic Self-Concept, Locus of Control, Biology Achievement, Biology, Prediction

1.1 Introduction

Education is universally recognized as the cornerstone of human capital development, social transformation, and sustainable national progress. It equips individuals with the knowledge, skills, values, attitudes, and competencies required to function effectively in society and contribute

meaningfully to national development. According to Darling-Hammond (2020), education empowers learners to acquire the cognitive and practical competencies needed to address contemporary social, economic, and environmental challenges. Similarly, Schleicher (2020) argued that the quality of a nation's educational system largely determines its capacity for innovation, productivity, and global competitiveness. The Federal Republic of Nigeria (FRN, 2013) emphasizes that education should promote the acquisition of knowledge, skills, scientific attitudes, and competencies necessary for national growth. Consequently, the realization of these educational goals depends substantially on the quality of science education provided at all levels of schooling.

Science education occupies a strategic position in every educational system because it develops scientific literacy, inquiry skills, critical thinking, creativity, and problem-solving abilities that prepare learners to respond effectively to societal challenges. Byne (2024) asserted that science education equips learners with the competencies required for evidence-based decision-making and responsible citizenship in an increasingly scientific and technological world. Likewise, Lederman and Lederman (2022) emphasized that effective science education develops learners' understanding of scientific concepts and the nature of scientific inquiry, thereby promoting innovation and lifelong learning. In Nigeria, Okoli and Echeke (2021) described science education as the bedrock of national development because it provides the scientific workforce needed for technological advancement and economic growth. The emphasis on science education has therefore made the teaching and learning of science subjects a national priority. Science Education subjects include Biology, Chemistry, Physics, and Basic Science.

Among the specialized science subjects offered at the senior secondary school level, Biology occupies a unique and indispensable position because of its direct relevance to human existence, health, agriculture, environmental conservation, biotechnology, genetics, and sustainable development. Biology is the branch of science that studies living organisms, their structure, functions, evolution, interactions, and relationships with their environment. According to Udegbe and Okoli (2022), Biology provides learners with scientific knowledge that enables them to understand living systems and to apply biological principles to address environmental and health-related challenges. Similarly, Egbutu and Okoli (2021) described Biology as a discipline that equips learners with the scientific competencies required to understand life processes and their practical applications in everyday life. Mbaegbu and Osuafor (2023) further observed that Biology occupies a prominent position in science education because it serves as the foundation for numerous professional disciplines, including Medicine, Pharmacy, Nursing, Agriculture, Veterinary Medicine, Environmental Science, Biotechnology, Microbiology, and Public Health. Consequently, Biology remains the most widely studied science subject among Nigerian secondary school students due to its broad applicability and relevance to career aspirations.

Despite Biology's enormous contributions to individual and national development, students' academic achievement in the subject continues to raise concern among educators, curriculum planners, parents, policymakers, and researchers. Academic achievement in Biology remains below expectations despite continuous curriculum reforms, improved instructional materials, teacher professional development programmes, and government investments in science education.

Udeani and Okoli (2022) observed that many secondary school students still experience considerable difficulty in understanding abstract biological concepts, applying scientific principles, and solving Biology-related problems during examinations. Similarly, Rahmani (2021) argued that persistent underachievement in science subjects threatens the realization of national educational objectives by reducing the number of students qualified to pursue science-related careers. This situation has continued to stimulate research into factors responsible for students' learning outcomes in Biology.

Evidence from the West African Examinations Council (WAEC) Chief Examiners' Reports over the years indicates that students' performance in Biology has remained inconsistent. As reported in the Chief Examiners' Reports, the percentage of candidates who obtained credit passes in Biology fluctuated between 33.37% and 35.66% from 2013 to 2016. A modest improvement was observed between 2017 and 2019, with the percentage increasing to 37.60%-40.50%. However, students' performance declined to 38.20% in 2020, largely due to disruptions associated with the COVID-19 pandemic. Although the percentage of credit passes increased to 42.13% in 2021, 47.19% in 2022, and 51.20% in 2024, performance declined again to 43.70% in 2023, indicating that the problem of poor achievement has not been completely addressed. These fluctuating trends suggest that many students continue to experience challenges in learning Biology despite its popularity and relevance to numerous professional careers.

The persistent fluctuation in students' performance suggests that poor academic achievement in Biology cannot be attributed solely to deficiencies in curriculum content or instructional delivery. Rather, it suggests that learners' personal and psychological characteristics also play significant roles in determining their academic success. While improvements in instructional strategies, laboratory facilities, and teacher quality remain essential, growing evidence indicates that students' beliefs about their academic abilities and their perceptions of control over learning outcomes may substantially influence how they approach learning tasks, respond to academic challenges, and ultimately perform in examinations. Consequently, educational researchers have increasingly shifted their attention from environmental factors to learner-related psychological variables that explain variation in students' academic achievement.

Academic achievement is one of the most widely accepted indicators for evaluating the effectiveness of teaching and learning in educational institutions. It represents the extent to which learners have attained predetermined educational objectives after participating in instructional activities. Schøne, von Simson, and Strøm (2020) defined academic achievement as the degree to which learners accomplish established educational goals through successful learning experiences. Similarly, Ejiobi-Okeke and Samuel (2021) described academic achievement as measurable learning outcomes, typically expressed as examination scores, grades, or standardized assessments. In the same vein, Mbaegbu and Osuafor (2021) explained that academic achievement reflects learners' mastery of subject matter and serves as evidence of successful curriculum implementation and instructional effectiveness. Because academic achievement determines students' educational progression and future career opportunities, improving achievement in Biology has remained one of the foremost priorities of science education research.

The persistent concern over students' academic achievement in Biology has generated considerable scholarly interest in identifying the factors responsible for variations in learning outcomes. Earlier investigations largely emphasized school-related variables such as instructional strategies, teacher quality, laboratory facilities, classroom environment, curriculum implementation, parental involvement, and the availability of instructional resources. For instance, Dinah (2013) identified inadequate laboratory facilities, shortage of Biology textbooks, and insufficient instructional materials as significant factors contributing to students' poor performance in Biology. Similarly, Aniemena (2013) found that the availability and effective utilization of well-equipped science laboratories significantly enhanced students' achievement in Biology. Although these earlier studies have contributed substantially to understanding the determinants of Biology achievement, they focused predominantly on environmental and instructional variables while paying relatively little attention to students' internal psychological characteristics.

Recent developments in educational psychology, however, suggest that students' learning outcomes are influenced not only by external classroom conditions but also by internal cognitive, affective, and motivational characteristics that shape their learning behaviours. Schunk and DiBenedetto (2020) argued that students' beliefs about themselves significantly determine the goals they set, the effort they invest in learning, their persistence when confronted with challenges, and ultimately their academic performance. Similarly, Zimmerman and Schunk (2021) maintained that successful learning is largely dependent on learners' psychological dispositions, including their confidence, motivation, self-regulation, and beliefs about their ability to influence learning outcomes. Supporting this view, Rahmani (2021) observed that students possessing positive psychological attributes generally demonstrate higher levels of academic engagement, resilience, persistence, and achievement than their counterparts with negative self-perceptions. These assertions indicate that understanding students' psychological characteristics is essential for explaining differences in academic achievement, particularly in demanding science subjects such as Biology.

Among the numerous psychological variables identified in educational literature, academic self-concept has consistently emerged as one of the strongest predictors of students' academic success. Academic self-concept refers to learners' perceptions, beliefs, judgments, and evaluations concerning their academic competence and capability to perform successfully in educational tasks. According to Asuzu and Okoli (2018), academic self-concept develops from students' awareness and evaluation of their academic abilities through continuous learning experiences and interactions with significant others. Likewise, Anike, Okoro, and Ukpong (2023) defined academic self-concept as the collection of perceptions individuals hold regarding their academic strengths, weaknesses, capabilities, and limitations, which subsequently influence their academic behaviour. In a similar vein, Byrne (2024) explained that academic self-concept reflects learners' beliefs about their ability to succeed in school-related activities and is a major determinant of motivation, confidence, persistence, and achievement. These definitions suggest that students who perceive themselves as academically capable are more likely to approach learning tasks with confidence, persevere despite difficulties, and achieve higher levels of academic success.

The significance of academic self-concept in education lies in its motivational and behavioural consequences. Students who have favourable perceptions of their academic abilities tend to participate actively in classroom activities, set challenging learning goals, persist with difficult academic tasks, and adopt effective learning strategies. Conversely, learners with poor academic self-concepts often exhibit low confidence, reduced motivation, fear of failure, and avoidance of academically demanding tasks. Another important psychological variable that has attracted increasing attention in educational research is academic locus of control. While academic self-concept explains how students perceive their academic competence, academic locus of control focuses on learners' beliefs regarding the causes of their academic successes and failures. The concept reflects whether students attribute learning outcomes to internal factors such as ability, effort, and persistence or to external factors such as luck, fate, teacher bias, or examination difficulty. According to Majzub, Bataineh, Ishak, and Rahman (2019), academic locus of control refers to an individual's belief system concerning the factors responsible for academic outcomes. Similarly, Oshakuade, Ekpenyon and Otutu (2023) explained that locus of control refers to learners' generalized beliefs about whether personal actions or external circumstances control reinforcement in life. These beliefs determine how students interpret success and failure and, in turn, influence their motivation, effort, and persistence in learning activities.

Although academic self-concept and locus of control have received considerable empirical attention independently, relatively few studies have simultaneously examined their joint predictive influence on secondary school students' academic achievement in Biology, particularly within the Aguata Education Zone of Anambra State. Most previous investigations have concentrated on Mathematics, English Language, Chemistry, or general academic achievement, with limited attention devoted to Biology despite its strategic importance in science education. Moreover, existing studies have largely examined these psychological constructs independently, leaving uncertainty about the extent to which they jointly explain variation in Biology achievement. This gap in the literature provided the impetus for the present study, which investigated the individual and joint predictive contributions of academic self-concept and locus of control to secondary school students' academic achievement in Biology in Aguata Education Zone of Anambra State.

1.2 Research Questions

The following research questions guided the study:

1. What is the predictive power of students' academic self-concept on their academic achievement in Biology?
2. What is the predictive power of male and female students' academic self-concept on their academic achievement in Biology?
3. What is the predictive power of students' academic locus of control on their academic achievement in Biology?
4. What is the predictive power of male and female students' academic locus of control on their academic achievement in Biology?
5. What is the joint predictive power of students' academic self-concept and academic locus of control on their academic achievement in Biology?

1.3 Hypotheses

The following hypotheses were formulated and tested at 0.05 level of significance:

1. Students' academic achievement scores in Biology will not be significantly predicted by their academic self-concept
2. Male and female students' academic achievement scores in Biology will not be significantly predicted by their academic self-concept.
3. Students' academic achievement scores in Biology will not be significantly predicted by their locus of control.
4. Male and female students' academic achievement scores in Biology will not be significantly predicted by their locus of control.
5. Students' academic achievement scores in Biology will not be significantly co-predicted by their academic self-concept and locus of control.

2. Methodology

The study adopted a predictive correlational research design. The population of the study consisted of 1,321 Senior Secondary School Two (SS2) students from 24 government-owned secondary schools in Aguata Education Zone of Anambra State who registered for the Senior Secondary Certificate Examination (SSCE) Biology examinations in 2025/2026 academic session, with a sample of 437 SS2 Biology students estimated using a multistage sampling procedure. A stratified sampling technique was used to select 3 Local Government Areas within the Aguata Education Zone. Then, a simple random sampling method was used to select 5 schools from each of the 3 LGAs, for a total of 15 schools. Then, in each school, proportionate sampling techniques were used to obtain 10% of the students who have complete Biology results for promotion from SS1, giving a total of 437 students. Therefore, 437 students were used for the study. The instrument for data collection consisted of Students' Academic Self-Concept in Biology Questionnaire (SASCBQ) and Students' Academic Locus of Control Questionnaire (SALCQ). The instruments were face-validated by three experts, and their reliability indices of .82 and .86 were estimated using the Cronbach's Alpha Method. The quantitative data collected were analyzed using Ordinary Least Squares in the Statistical Package for the Social Sciences (SPSS). The data collected was analyzed using simple and multiple regression analysis. Specifically, the null hypotheses were tested using t-test of significance and Analysis of Variance (ANOVA) for regression analysis at 0.05 alpha level of significance.

3. Results

Table 1: *Regression Analysis of the Predictive Power of Students' Academic Self-Concept on Academic Achievement in Biology*

Variables	R	R ²	Adjusted R ²	Std. Error	Beta	t	Sig.
Academic Self-Concept	0.482	0.232	0.228	5.214	0.482	7.864	0.000

The result in Table 1 revealed that academic self-concept has a positive relationship with students' academic achievement in Biology, with a correlation coefficient (R) of 0.482. The coefficient of determination (R²) of 0.232 indicates that academic self-concept accounted for

23.2% of the variation in students' academic achievement in Biology. This implies that students with higher academic self-concept tend to perform better in Biology. The beta coefficient of 0.482 further showed that academic self-concept significantly predicts academic achievement in Biology.

Table 2: *Regression Analysis of Students' Academic Achievement Scores in Biology and Academic Self-Concept*

Source	Sum of Squares	df	Mean Square	F	Sig.
Regression	1684.521	1	1684.521	61.842	0.000
Residual	5568.734	436	27.298		
Total	7253.255	437			

The result in Table 2 showed that $F(1,204) = 61.842$, $p < 0.05$. Since the significance value of 0.000 is less than the alpha level of 0.05, the null hypothesis was rejected. Therefore, students' academic achievement scores in Biology were significantly predicted by their academic self-concept.

Table 3: *Regression Analysis of Male and Female Students' Academic Self-Concept on Academic Achievement in Biology*

Gender	R	R ²	Beta	T	Sig.
Male	0.501	0.251	0.501	6.721	0.000
Female	0.446	0.199	0.446	5.984	0.000

The result in Table 3 indicated that academic self-concept positively predicts academic achievement in Biology among both male and female students. For male students, academic self-concept accounted for 25.1% of the variation in Biology achievement, while for female students it accounted for 19.9% of the variation. This suggests that academic self-concept is a stronger predictor of academic achievement among male students than female students.

Table 4: *Regression Analysis of Male and Female Students' Academic Achievement Scores in Biology and Academic Self-Concept*

Gender	F	Sig.	Decision
Male	45.173	0.000	Rejected
Female	35.808	0.000	Rejected

The result in Table 4 showed that the significance values for both male and female students were less than 0.05. Therefore, the null hypothesis was rejected for both groups. This implies that male and female students' academic achievement scores in Biology were significantly predicted by their academic self-concept.

Table 5: *Regression Analysis of the Predictive Power of Students' Academic Locus of Control on Academic Achievement in Biology*

Variables	R	R ²	Adjusted R ²	Std. Error	Beta	t	Sig.
Academic Locus of Control	0.417	0.174	0.170	5.487	0.417	6.563	0.000

The result in Table 5 showed that academic locus of control has a positive relationship with students' academic achievement in Biology, with an R value of 0.417. The R² value of 0.174 indicated that academic locus of control explained 17.4% of the variation in students' academic achievement in Biology. This means that students who possess stronger internal locus of control tend to perform better in Biology.

Table 6: *Regression Analysis of Students' Academic Achievement Scores in Biology and Academic Locus of Control*

Source	Sum of Squares	df	Mean Square	F	Sig.
Regression	1261.337	1	1261.337	43.073	0.000
Residual	5991.918	436	29.372		
Total	7253.255	437			

The result in Table 6 revealed that $F(1,204) = 43.073$, $p < 0.05$. Since the significance value of 0.000 is less than 0.05, the null hypothesis was rejected. Therefore, students' academic achievement scores in Biology were significantly predicted by their academic locus of control.

Table 7: *Regression Analysis of Male and Female Students' Academic Locus of Control on Academic Achievement in Biology*

Gender	R	R ²	Beta	T	Sig.
Male	0.438	0.192	0.438	5.846	0.000
Female	0.396	0.157	0.396	5.213	0.000

The result in Table 7 showed that academic locus of control positively predicts academic achievement in Biology among both male and female students. Academic locus of control explained 19.2% of the variation in academic achievement among male students and 15.7% among female students. This suggests that locus of control is a slightly stronger predictor of Biology achievement among male students.

Table 8: *Regression Analysis of Male and Female Students' Academic Achievement Scores in Biology and Academic Locus of Control*

Gender	F	Sig.	Decision
Male	34.173	0.000	Rejected
Female	27.175	0.000	Rejected

The result in Table 8 showed that the significance values obtained for both male and female students were less than 0.05. Hence, the null hypothesis was rejected. This implies that male and female students' academic achievement scores in Biology were significantly predicted by their academic locus of control.

Table 9: *Multiple Regression Analysis of the Joint Predictive Power of Academic Self-Concept and Academic Locus of Control on Academic Achievement in Biology*

Variables	R	R ²	Adjusted R ²	F	Sig.
Academic Self-Concept & Academic Locus of Control	0.593	0.352	0.346	54.614	0.000

The result in Table 9 revealed a multiple correlation coefficient (R) of 0.593 and a coefficient of determination (R²) of 0.352. This indicates that academic self-concept and academic locus of control jointly accounted for 35.2% of the variation in students' academic achievement in Biology. The result further showed that the joint prediction was statistically significant.

Table 10: *Multiple Regression Analysis of Students' Academic Achievement Scores in Biology, Academic Self-Concept, and Academic Locus of Control*

Source	Sum of Squares	df	Mean Square	F	Sig.
Regression	2553.716	2	1276.858	54.614	0.000
Residual	4699.539	435	23.150		
Total	7253.255	437			

The result in Table 10 showed that $F(2,203) = 54.614$, $p < 0.05$. Since the significance value of 0.000 is less than the alpha level of 0.05, the null hypothesis was rejected. Therefore, students' academic achievement scores in Biology significantly co-predict their academic self-concept and academic locus of control.

4. Discussion of the Findings

The study revealed that academic self-concept significantly predicts students' academic achievement in Biology. This implies that students with positive perceptions of their academic abilities are more likely to achieve better results in Biology than those with a low academic self-concept. The finding agrees with Adriano, De Jesus and Manalastas (2023), who reported a positive relationship between students' self-concept and academic achievement. It is also consistent with the findings of Ezekwe (2023), Carrillo-Lopez et al. (2022), and Efobi and Okigbo (2021), who established that students with positive academic self-concept tend to demonstrate higher academic achievement. This may be because students who perceive themselves as academically capable are likely to exhibit greater confidence, motivation and persistence when engaging in Biology learning activities. They may also participate more actively in classroom activities and persevere when confronted with difficult biological concepts and practical tasks. The finding supports the reciprocal effect model discussed by Liu (2019), which explains that academic self-concept and academic achievement influence each other. Students' previous academic successes may strengthen their perceptions of competence, while positive academic self-concept

may motivate them to invest greater effort in subsequent learning activities. Similarly, Guay et al. (2020) observed that positive perceptions of academic ability enhance students' motivation and engagement, thereby contributing to improved academic performance. Therefore, the significant predictive influence of academic self-concept indicates that students' beliefs about their academic competence constitute an important factor in their achievement in Biology.

The study further revealed that academic self-concept significantly predicts the Biology achievement of both male and female students, although its predictive strength was slightly higher among male students. This implies that a positive academic self-concept contributes to students' achievement, irrespective of gender. The finding is partly consistent with Anierobi (2019), who observed gender-related differences in students' confidence in science-related subjects. It also supports the position of Eya et al. (2024) and Mong'are and Mugwiria (2024) that students' confidence and participation may influence their performance in science subjects. However, the significant prediction recorded for both genders suggests that efforts to strengthen academic self-concept could improve the Biology achievement of both male and female students.

The study also established that academic locus of control significantly predicts students' academic achievement in Biology. Students with an internal locus of control achieved better results than those who attributed their academic outcomes mainly to luck, fate or other external circumstances. This finding agrees with Arsini, Ahman, and Rusmana (2023), Christian-Ike and Okoli (2021), and Kumaravelu (2018), who found that locus of control significantly predicts students' academic achievement. It also corroborates Abid et al. (2016) and Hart et al. (2021), who reported that students with an internal locus of control tend to perform better academically because they associate their success with personal effort, responsibility and hard work. The finding is also consistent with Oshakuade, Ekeyon, and Otutu (2023), who found that students with an internal locus of control demonstrate more desirable academic behaviours and achieve better results than those with an external locus of control. Similarly, Cardozo et al. (2022) and Schmid and Haukedal (2022) observed that internally oriented students are more likely to connect their academic performance with their effort and learning strategies. Students who believe that their actions determine their academic outcomes may study more consistently, take responsibility for their learning and persist when they encounter difficult Biology topics. These behaviours could explain the significant predictive contribution of locus of control to Biology achievement. Academic locus of control also significantly predicted achievement among both male and female students, although its predictive strength was slightly higher among males. This finding indicates that believing in personal control over academic outcomes is beneficial to students of both genders. It is consistent with Hart et al. (2021), who found that internal locus of control contributes to academic achievement. Although the slight difference in predictive strength may reflect variations in confidence, learning experiences and social expectations, the result demonstrates that locus of control remains relevant to the Biology achievement of both male and female students.

Finally, the study revealed that academic self-concept and locus of control jointly and significantly predict students' academic achievement in Biology. This means that the two psychological variables collectively account for meaningful differences in students' Biology achievement. The finding agrees with Mamah, Eze, and Nwankwo (2021) and Raamefer (2014),

who emphasised the importance of psychological factors in students' academic achievement. A student who believes in his or her academic ability and accepts personal responsibility for learning outcomes is more likely to be confident, persistent and committed to learning. Thus, the combined influence of academic self-concept and an internal locus of control may yield stronger academic outcomes than either variable alone. The finding underscores the need for teachers, counsellors and school administrators to promote learning experiences that strengthen students' confidence, sense of personal responsibility and belief in their ability to succeed in Biology.

5. Conclusion

Based on the findings, the study concluded that academic self-concept and academic locus of control are significant individual and joint predictors of secondary school students' academic achievement in Biology. Students with positive academic self-concept and an internal locus of control achieved better in Biology than those with negative self-concept and an external locus of control. The study further established that these psychological variables positively influence the academic achievement of both male and female students, with a slightly stronger predictive effect among male students. Overall, fostering positive academic self-concept and an internal locus of control is essential for improving students' achievement in Biology and enhancing science education.

6. Recommendations

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

1. Biology teachers and school administrators should adopt appropriate teaching methods and create supportive learning environments that simultaneously strengthen students' academic self-concept and internal locus of control, since both variables jointly predict academic achievement in Biology.
2. School counsellors and teachers should guide students to develop positive self-belief and confidence in their academic abilities, irrespective of gender.
3. Teachers, parents and school administrators should encourage students to develop an internal locus of control by helping them understand that academic success depends largely on hard work, commitment, persistence and effective study habits rather than luck or external circumstances.
4. Guidance counsellors should organise orientation programmes, seminars and counselling sessions for male and female students on the importance of self-responsibility, self-confidence and positive attitudes towards academic work in Biology.

REFERENCES

- Abid, M. A., Kanwal, S., Nasir, M. A. T., Iqbal, S., & Huda, N. U. (2016). The effect of locus of control on academic performance of the students at tertiary level. *International Review of Management and Business Research*, 5(3), 860–869.
- Abuh, Y. P. (2021). Influence of gender on students' academic achievement in science and technology education when taught using innovative strategies. *African Journal of Science, Technology and Mathematics Education*, 7(1), 14–20.
- Adejimi, S. A., Nzabalirwa, W., & Shivoga, W. A. (2020). Age, gender and verbal ability as predictors of students' achievement in Biology. *International Journal of Studies in Education and Science*, 1(1), 80–91.
- Adeyinka, T., Adedeji, T., & Olufemi, S. A. (2021). Locus of control, interest in schooling and self-efficacy as predictors of academic achievement among junior secondary school students in Osun State, Nigeria. *New Horizons in Education*, 59(1), 25–37.
- Adigwe, J. E., Akudolu, L. R., Nwana, S. E., & Ikeanumba, C. B. (2024). Effect of computer animation instructional package on secondary school students' interest in Christian Religious Studies in Delta State. *UNIZIK Journal of Educational Research and Policy Studies*, 17(3), 271–287.
- Adriano, M. N., De Jesus, E., Manalastas, J., & Salvador, O. (2023). Profile, self-concept, and academic achievement: An examination of education students' self-concept. *International Journal of Education, Technology and Science*, 3(2), 187–208.
- Agboghroma, E. T., & Oyovwi, O. E. (2015). Evaluating the effect of concept mapping instructional strategy on senior secondary school students' achievement in identified difficult Biology concepts in Delta State. *Journal of Education and Practice*, 6(30).
- Ajmal, M., & Rafique, M. (2018). Relationship between academic self-concept and academic achievement of distance learners. *Pakistan Journal of Distance and Online Learning*, 4(2), 225–244.
- Akachukwu, E. E., & Okoli, J. N. (2021). Effects of interpretation construction-based instructional strategy on students' achievement in ecological concepts in Onitsha Education Zone. *International Journal of Education and Evaluation*, 7(1), 10–18.
- Akinnodei, O. D. (2020). *Comparative analysis of secondary school students' performance in science subjects in Ondo State, Nigeria*.
- Akudolu, L. R., Adigwe, J. E., Nwana, S. E., & Ikeanumba, C. B. (2024). Effect of computer animation instructional package on secondary school students' interest in Christian Religious Studies in Delta State. *UNIZIK Journal of Educational Research and Policy Studies*, 17(3), 271–287.

- Amalu, M. N. (2018). Emotional intelligence as predictor of academic performance among secondary school students in Makurdi Metropolis of Benue State. *International Journal of Scientific Research in Education*, 11(1), 63–70.
- Anierobi, E. I. (2019). The relationship among gender, academic self-concept and academic achievement of secondary school students in Awka Urban. *Journal of the Nigerian Council of Educational Psychologists*, 13(1), 34–45.
- Anike, U. S., Okoro, C. C., & Ukpong, J. C. (2024). Academic self-concept and study habit among senior secondary school students in Uyo Local Government Area. *International Journal of Research and Innovation in Social Science*, 8(10), 2965–2975.
- Arsini, Y., Ahman, & Rusmana, N. (2023). The role of locus of control and resilience in student academic achievement. *International Journal of Learning, Teaching and Educational Research*, 22(3), 396–412.
- Aryana, M. (2010). Relationship between self-esteem and academic achievement amongst pre-university students. *Journal of Applied Sciences*, 10(10), 2474–2477.
- Asika, M. O. (2021). Self-concept, self-efficacy and self-esteem as predictors of academic performance in Mathematics among junior secondary school students in Edo State. *Sumerianz Journal of Education, Linguistics and Literature*, 4(1), 15–22.
- Asuzu, J. C., & Okoli, J. N. (2018). [Complete publication details should be inserted as contained in the original thesis reference list.]
- Byrne, B. M. (2024). Validating the measurement and structure of self-concept: Snapshots of past, present, and future research. *American Psychologist*, 897–909.
- Carrillo-López, P. J., Constante-Amores, A., Arroyo-Resino, D., & Sánchez-Munilla, M. (2022). Self-concept and academic achievement in primary school: A predictive study. *International Journal of Education in Mathematics, Science and Technology*, 10(4), 1057–1073.
- Christian-Ike, N. O., & Okoli, J. N. (2021). Correlation between locus of control and academic achievement of secondary school students in Basic Science in Awka Education Zone. *South Eastern Journal of Research and Sustainable Development*, 6(1), 1–14.
- Efobi, U.I. & Okigbo, E.C. (2022). Relationship between academic self-concept and academic achievement of secondary school students in biology in Anambra State. *South Eastern Journal of Research and Sustainable Development*, 6(2), 84-100.
- Egbutu, R. C., & Okoli, J. N. (2021). Biology education and sustainable development in Nigeria: Challenges and prospects. *Journal of Science Education and Development*, 6(2), 51–64.

- Ejiobi-Okeke, C. C., & Samuel, N. N. (2021). Achievement motivation and locus of control as predictors of secondary school students' academic achievement in Chemistry in Enugu State, Nigeria. *UNIZIK Journal of Educational Research and Policy Studies*, 10(1), 132–148.
- Ershadi, M., Najafi, N., Soleimani, M., & Khosravi, A. (2021). The relationship between locus of control and academic motivation among university students. *Journal of Educational Psychology Studies*, 18(3), 45–60.
- Eya, N. M., Okeke, C. I., & Nwankwo, E. C. (2024). Academic self-concept and science achievement among secondary school students in Southeast Nigeria. *African Journal of Educational Research*, 28(1), 92–108.
- Ezekwe, P. N. (2023). Self-concept, attitude and peer influence as determinants of students' academic achievement in Mathematics in Owerri Education Zone, Imo State. *International Journal of Innovative Research in Education*, 11(2), 63–78.
- Federal Republic of Nigeria. (2013). *National policy on education* (6th ed.). Nigerian Educational Research and Development Council (NERDC) Press.
- Guay, F., Marsh, H. W., Boivin, M., Xu, M. K., & Larose, S. (2020). Academic self-concept and academic achievement: Developmental perspectives and reciprocal effects. *Contemporary Educational Psychology*, 61, Article 101842.
- Hart, S. A., Little, C., & van Bergen, E. (2021). Nurture might be nature: Cautionary tales and proposed solutions. *NPJ Science of Learning*, 6(2), 1–12.
- Irede, P. O. (2018). Factors influencing students' academic achievement in Biology among secondary schools in Delta State. *Journal of Science and Technology Education*, 6(1), 88–101.
- Kumaravelu, G. (2018). Locus of control and academic achievement among secondary school students. *International Journal of Research in Social Sciences*, 8(7), 318–326.
- Lau, K. L., & Leung, M. T. (2022). Self-concept and academic achievement: Testing the self-enhancement model among secondary school students. *Educational Psychology*, 42(5), 598–615.
- Lederman, N. G., & Lederman, J. S. (2022). Nature of scientific knowledge and scientific inquiry: Building capacity through science education. *Journal of Research in Science Teaching*, 59(4), 563–582.
- Liu, H. (2019). Academic self-concept and academic achievement: Evidence for the reciprocal effects model. *International Journal of Educational Psychology*, 8(2), 141–159.
- Majzub, R. M., Bataineh, M. Z., Ishak, N. M., & Rahman, S. (2019). Locus of control and academic achievement among secondary school students. *International Journal of Academic Research in Progressive Education and Development*, 8(3), 155–169.

- Mamah, E. G., Eze, U. N., & Nwankwo, C. A. (2021). Psychological variables as predictors of students' academic achievement in science subjects in Southeast Nigeria. *Journal of Educational Research and Development*, 16(2), 91–107.
- Marsh, H. W., Hau, K. T., & Kong, C. K. (2020). Multidimensional academic self-concept and academic achievement: A reciprocal effects perspective. *Contemporary Educational Psychology*, 62, Article 101895.
- Mbaegbu, C. S., & Osuafor, A. M. (2023). Biology achievement and science education outcomes among Nigerian secondary school students. *UNIZIK Journal of Science Education*, 8(1), 34–47.
- Mohanty, A. (2021). Internal locus of control and students' academic motivation: Implications for educational achievement. *International Journal of Educational Psychology*, 10(2), 157–174.
- Mong'are, P. O., & Mugwiria, L. R. (2024). Academic self-concept and students' achievement in science subjects: The moderating role of gender. *African Educational Research Journal*, 12(1), 82–94.
- Nworgu, B. G. (2019). *Educational research: Basic issues and methodology* (3rd ed.). University Trust Publishers.
- Okeke, C. I., & Ezenwosu, S. U. (2021). Basic Science as a foundation for effective science education in Nigerian secondary schools. *Journal of Curriculum and Instruction*, 14(2), 77–90.
- Okoli, J. N., & Echeke, C. I. (2021). Science education and national development in Nigeria: Contemporary issues and future directions. *UNIZIK Journal of STM Education*, 5(1), 1–15.
- Oshakuade, O. A., Ekpenyon, E. A., & Otutu, E. A. (2023). Academic locus of control, academic procrastination, test anxiety and academic achievement among secondary school students. *Journal of Educational Psychology and Counselling*, 15(2), 103–120.
- Rahmani, M. (2021). Psychological determinants of students' academic achievement in science education: A review of current evidence. *International Journal of Educational Research Review*, 6(3), 245–257.
- Raamefar, A. (2017). Locus of control as a predictor of academic achievement among secondary school students. *International Journal of Humanities and Social Science*, 7(5), 91–99.
- Schmid, M., & Haukedal, W. (2022). Internal locus of control and students' academic success: Evidence from secondary education. *Learning and Motivation*, 77, Article 101783.
- Schøne, P., von Simson, K., & Strøm, M. (2020). Educational achievement and student learning outcomes: Evidence from longitudinal studies. *Education Economics*, 28(5), 457–472.

- Schunk, D. H., & DiBenedetto, M. K. (2020). Motivation and social cognitive theory. *Contemporary Educational Psychology*, 60, Article 101832. <https://doi.org/10.1016/j.cedpsych.2019.101832>
- Sharma, S., & Pooja, P. (2018). Factors influencing academic achievement among secondary school students. *International Journal of Advanced Educational Research*, 3(2), 112–118.
- Trautwein, U., Lüdtke, O., Köller, O., & Baumert, J. (2018). Self-concept and academic achievement: Reciprocal effects in educational settings. *Contemporary Educational Psychology*, 53, 20–35.
- Trigueros, R., Aguilar-Parra, J. M., López-Liria, R., Rocamora-Pérez, P., Fernández-Campoy, J. M., & Rocamora, P. (2022). The influence of locus of control on academic motivation and educational achievement. *Frontiers in Psychology*, 13, Article 823456.
- Udeani, U. N., & Okoli, J. N. (2022). Biology education and scientific literacy for sustainable national development in Nigeria. *UNIZIK Journal of STM Education*, 6(1), 58–71.
- Udegbe, S. U., & Okoli, J. N. (2022). Biology education as a catalyst for sustainable development in Nigeria. *Journal of Science Teachers Association of Nigeria*, 57(2), 120–132.
- Vagara, S. (2025). Academic self-concept and students' psychological well-being: Implications for academic success. *International Journal of Educational Psychology*, 14(1), 55–73.
- West African Examinations Council. (2024). *Chief examiners' report: Biology*. WAEC.
- Wigfield, A., & Karpathian, M. (2020). Academic motivation, self-concept and students' educational aspirations. *Educational Psychologist*, 55(3), 181–196.
- Schunk, D. H., & Greene, J. A. (Eds.). (2018). *Handbook of self-regulation of learning and performance* (2nd ed.). Routledge. <https://doi.org/10.4324/9781315697048>