UNDERGRADUATE STUDENTS' SCIENCE PROCESS SKILLS AS PREDICTOR OF ACADEMIC ACHIEVEMENT IN SCIENCE EDUCATION COURSES

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Abstract: *In a quest to determine if science process skills significantly influence academic achievement in undergraduate science education courses, this study examined undergraduate students' science process skills as predictor of academic achievement in science education courses. Two research questions guided the study while two hypotheses were tested at 0.05 alpha level. The predictive correlation survey design was adopted. The population of the study comprised 2720 undergraduate science education department students in Anambra State, Nigeria. A Sample size of 408 undergraduate science education students were drawn using 15% of total population in the study (2720) as postulated by Nworgu in Abumchukwu et al.,(2024b). Undergraduate Students Science Process Skills Scale (USSPSS) and 2023/2024 academic session average scores of undergraduate students' science education courses were instruments used for data collection. The instruments were validated by three experts. The reliability of the USSPSS was established using Cronbach alpha method and*

reliability coefficients of 0.73 was found. The two instruments were used as a method for data collection. Coefficient R and R2 were used to answer research questions while regression ANOVA (linear and multiple) were used to test the hypotheses. The findings from the results revealed that a low positive predictive value exist between Undergraduate students' science process skills (USSPS) and their academic achievement in science education courses. However, undergraduate science process skills (USSPS) is not a significant predictor of the students' academic achievement in science education courses. More so, a low positive predictive value exist between undergraduate students' science process skills (USSPS) and the students' academic achievement as moderated by gender in science education courses. Thus, undergraduate science process skill is not a significant predictor of the academic achievement of male and female undergraduate students in science education courses. From the findings, recommendations and conclusions were made.

Keywords: *undergraduate; science; education; students; science process skills.*

Introduction

Undergraduate students are individuals pursuing their first level of post-secondary education, typically within a college or university setting. This stage usually spans around four years or more, depending on the program and institution. Undergraduates can pursue various degrees, including Associate, Bachelor of Arts, Bachelor of Science, and more specialized fields. But as a result of this study, undergraduate students in science education department was the area of focus.

Undergraduate science education students are individuals enrolled in degree programs focused on teaching science subjects. They typically study principles of pedagogy, curriculum development, and scientific content across disciplines like Biology, Chemistry, Computer studies, Integrated Science, Mathematics and Physics (Abumchukwu et al., 2024a). These students aim to become educators who inspire future generations in STEM fields through effective teaching practices.

More so, undergraduate science education students play a vital role in society as future educators who will shape the next generation's understanding of scientific principles. Their training equips them to inspire curiosity and critical thinking in students, fostering interest in STEM fields essential for innovation and progress (Obikezie et al.,

2025a). Within the educational system, undergraduate science education students contribute to developing effective curricula and teaching strategies, adapting to diverse learning needs. By instilling a strong foundation in science literacy, they empower students to make informed decisions about health, technology, and environmental issues (Nwuba et al., 2024a). Ultimately, these educators are crucial in building a scientifically informed citizenry, promoting societal advancement and addressing global challenges (Nwuba et al., 2024b). In spite all these contributions of undergraduate students and other students to the society and education in general, the achievement of these students in STEM related courses is a thing of worry to stakeholders (Nwuba et al., 2024a; Nwuba et al., 2024b).

Some scholars believed that undergraduate students often struggle with achieving impressive academic results in STEM-related courses, a challenge that can have far-reaching implications for their future careers as educators (Abumchukwu et al., 2024a; Nwuba et al., 2024a). According to reports from some scholars, several factors contribute to this phenomenon of undergraduate students' unimpressive academic achievement in STEM related courses includes the rigor of STEM curricula. Many undergraduate students encounter complex concepts and mathematical foundations that they might not have been fully prepared for, particularly if their prior education lacked a strong focus on these subjects (Eloy et al., 2025). More so, the interdisciplinary nature of science education requires students to integrate knowledge from Biology, Chemistry, Physics, and Mathematics, which can lead to feelings of overwhelm thereby might cause unimpressive academic achievement among students (Abumchukwu et al., 2024b; Eloy et al., 2025).

Another contributing factor to unimpressive academic achievement in STEM related field is the lack of engagement and support. Some students may find the traditional lecture-based format of STEM courses unengaging, which can negatively impact motivation and achievement (Ariely & Yarden 2025). This is to say that without hands-on and inquiry-based learning opportunities like science process skills, students may struggle to connect theoretical knowledge with practical applications (Obikezie et al., 2025b).

Moreover, external pressures such as financial stress, work commitments, and personal issues can detract from academic focus. But some group of authors maintained that lack of integration of science process skill could be a major factor militating against students' academic achievement (Obikezie et al., 2024).

Science process skills are the fundamental abilities required to engage in scientific inquiry. They include observing, classifying, measuring,

predicting, experimenting, interpreting data, and communicating results. These skills enable individuals to ask questions, solve problems, and explore natural phenomena systematically, fostering a deeper understanding of the scientific method and the world. According to Mutlu (2020) science process skills are crucial for students' academic achievement as they promote critical thinking and problem-solving abilities. By learning to observe, hypothesize, experiment, and analyze data, students develop a deeper understanding of scientific concepts. These skills enhance their ability to engage in scientific inquiry, fostering curiosity and innovation. Additionally, strong science process skills improve students' performance across disciplines, as they learn to approach problems methodically. Ultimately, mastering these skills helps students to become independent learners and informed citizens, ready to tackle complex challenges in an increasingly scientific and technological world (Mutlu, 2020).

No wonder Obikezie et. al. (2025a) observed a high prediction between urban secondary school students' science process skill and their academic achievement in senior secondary school science subject with no significant differences between the variables. Also Abumchukwu et. al. (2024) reported a high correlation between science process skills and secondary school Chemistry students' attitudes and achievement in emerging technology. The authors equally reported no significant different between secondary school students science process skill and their academic achievement in Chemistry not minding the gender differences.

Contrary, Umeji and Achufusi (2025a) revealed that low positive predictive value exist between students' science process skills and secondary school students' academic achievement in Physics. However, students' science process skills are not significant predictors of the academic achievement of secondary school students in physics. The authors further revealed that low positive predictive value exist between students' science process skills and academic achievement of male and female secondary school students in Physics. However, students' science process skills are not significant predictors of the academic achievement of male and female secondary school students in Physics. More so, Umeji and Achufusi (2025b) reported no discernible effect on either male or female students. The researchers also discovered a minimal positive predictive value between the academic achievement of secondary school students in Physics and the quality of their teachers.

It is particularly compelling that students' science process skills addresses a critical issue in STEM education. With undergraduate

science education students uniquely positioned to influence future generations, understanding the role of science process skills is essential. These skills not only enhance academic achievement but also develop essential critical thinking and problem-solving abilities. As some studies highlighted, weak integration of science process skills could be likely one of the factors that hinders undergraduate students' academic achievement. More so most of the studies cited so far were all done in secondary school and individual subject. This has already created a big gap. Despite the value science process skill has added to individual learner, the skills seems not to have gotten so much attention to be tested among undergraduate students. On this note, this study was motivated which investigated undergraduate students' science process skills as predictors of their academic achievement in science education courses.

Purpose of the Study
The purpose of the study was to investigate
1. Undergraduate students' science process skills as a predictor of academic achievement in science education courses.
2. Undergraduate students' science process skills as a predictor of academic achievement of male and female university students in science education courses.

Research Questions
The following research questions guided the study:
1. To what extent do undergraduate students' science process skills predict of students' academic achievement in science education courses?
2. To what extent do undergraduate students' science process skills predict of male and female university students in science education courses?

Hypotheses
The following hypotheses were tested at 0.05 level of significance:
1. Undergraduate students' science process skills are not significant predictors of students' academic achievement in science education courses.
2. Undergraduate students' science process skills are not significant predictors of male and female university students in science education courses.

Method

This study adopted predictive correlation design. The area of the study was Anambra State, Nigeria. The population comprised 2720 Undergraduate Science Education Students in all universities in Anambra State. The sample size for the study consisted of 408 Undergraduate Science Education Students. According to` Nworgu in Abumchukwu et. al. (2024b), a sample size of about 15% to 50% of the population depending on the population size is adequate for survey research. Thus, 15% of total population (2720) is 408 was used for the study due to the targeted population.

Instrument
The instruments for data collection are Undergraduate Students Science Process Skills Scale (USSPSS) and 2023/2024 academic session average scores of undergraduate students' science education courses from target sample size.
Undergraduate Students Science Process Skills Scale (USSPSS) was adapted by the researchers from Science Process Skills. This instrument was developed and used by Afif Hafez Zeidanand Majdi Rashed Jayosi in (2015) in study titled Science Process Skills and Attitudes toward Science among Palestinian Secondary School Studentsby. It has a reliability coefficient of 0.73 and consists of nine (9) science process skill namely; observation, measuring, classifying, predicting, communicating, controlling variables, hypothesizing, experimentation and data interpreting. The nine (9) clusters of the original instrument was compressed to five (5) clusters. This is because the five (5) clusters has the most common representation of science process skill as it is used in secondary schools in Nigeria. Four point scale response format was used which ranging from very low extent (1 point), low extent (2 point), high extent (3 point) and very high extent (4 point). The achievement scores were obtained from 2023/2024 academic session average scores of undergraduate students' science education courses. The results specified the students' achievement and was confirmed and validated by course coordinators and experts from measurement and evaluation. In interpreting the predictive value, the rule posited by Nworgu in Abumchukwu, et al., (2024b) about the interpretation was adopted for the interpretation of the study using the range of scores as thus:

Range of scores	Predictive Decision
$\pm0.80 - \pm 1.00$	High positive or negative value
$\pm0.31 - \pm 0.79$	Moderate positive or negative value

±0.00 – ± 0.30   Low positive or
negative value .

On the other hand, the null hypotheses were tested using regression analysis (linear and multiple). In interpreting the null hypotheses, the decision rule is that when P-value is less than or equal to 0.05 (P≤ 0.05) the null hypothesis was rejected. On the other hand, when P-value is greater than the alpha level 0.05 (P≥ 0.05), the null hypothesis was not rejected (uphold)

Results
Research Question 1: To what extent do undergraduate students' science process skills predict of students' academic achievement in science education courses?
Table 1: Regression Analysis of the Predictive Value of Undergraduate Science Process Skill and Academic Achievement in Science Education Courses

Model	N	R	R^2	Adjusted R^2	Std. Error	Decision
USSPS low						
Academic Achievement	408	.015	.013	.002	20.97177	prediction

a. Predictors: (Constant), USSPS

Table 1 shows predictive value of undergraduate students' science process skill and their academic achievement in science education courses as 0.015. It reveals that correlation coefficient R between undergraduate science process skills and their academic achievement in science education courses is 0.0015 indicating a low positive predictive value with associated coefficient of determination R^2 0.013.The coefficient of determination (.013) also known as the predictive value means that 1.3% of undergraduate students' science process skills accounted for the variation in academic achievement in science

education courses. This is an indication that 98.7% of variation in undergraduate students' academic achievement in science education courses is attributed to other factors other than their science process skills.

Research Question 2: To what extent do undergraduate students' science process skills predict of male and female university students in science education courses?

Table 2: Regression Analysis of the Predictive Value of Undergraduate Science Process Skills and Students' Academic Achievement in Science Education as Moderated by Gender

Model Error Decision	N	R	R^2	Adjusted R^2 Std.
USSPS Male low	133	.103	.011	
				0.0006 42.55776 Prediction
Female	275	.023	.001	

A. Predictors: (Constant), Gender Response on Undergraduate Students Science Process Skills

The result in Table 2 reveals predictive value of undergraduate science process skills and their academic achievement in science education courses as moderated by gender. It reveals that correlation coefficient R between undergraduate science process skills and male students' academic achievement in science education courses is 0.103 indicating a low positive predictive value with associated coefficient of determination R^2 in male as 0.011. The coefficient of determination (0.011) also known as the predictive value means that 1.1%of male undergraduate students' response on their science process skills accounted for the variation in academic achievement of male students in science education courses. This is an indication that 98.9% of

variation in male undergraduate students' academic achievement in science education courses is attributed to other factors other than their science process skills.This shows that improvement in undergraduate science process skills would lead to small increase in both male and female students' academic achievement in science education courses. Also in Table 2 shows correlation coefficient R between undergraduate science process skills and female students' academic achievement in science education is 0.023 indicating a low positive predictive value with associated coefficient of determination R^2 in female students as 0.01. The coefficient of determination (0.01) also known as the predictive value means that 1.0%of female students' response on undergraduate science process skills accounted for the variation in academic achievement in science education courses. This is an indication that 99% of variation in female undergraduate students' academic achievement in science education courses is attributed to other factors other than their science process skills.This shows that improvement in undergraduate science process skills would lead to small increase in both male and female students' academic achievement in science education courses.

HO$_1$: Undergraduate students' science process skills are not significant predictors of students' academic achievement in science education courses.

Table 3: Regression ANOVA Analysis of Predictive Significant of Undergraduate Science Process Skills and their Achievement in Science Education Courses

Model	Sum of Squares	Df	Mean Square	F	Sig
Regression	38.452	1	38.452	.087	.768[b]
Residual	178564.879	406	439.815		
Total	178603.331	407			

Table 3 reveals regression ANOVA analysis of predictive significant of undergraduate science process skills and their academic achievement in science education courses. The results show no significant difference $F (1, 406) = .087$, $p = .768 > .05$ indicating that

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undergraduate science process skills is not a significant predictor of the undergraduate academic achievement in science education courses. The inference drawn was that undergraduate science process skills is not a significant predictor of the academic achievement in science education courses.

HO$_2$: Undergraduate students' science process skills are not significant predictors of male and female university students in science education courses.

Table 4: Regression ANOVA Analysis of Predictive Significant of Undergraduate Science Process Skill and their Academic Achievement in Science Education Courses as Moderated by Gender

Model	Sum of Squares Sig		Df	Mean Square	F	
Regression	1233.070	3	411.023	.936	.423[b]	
Residual	177370.261	404	439.035			
Total	178603.331	407				

Table 4 reveals regression ANOVA analysis of predictive significant of undergraduate science process skills and male and female undergraduate academic achievement in science education courses.

The results show no significant difference $F(1, 404) = .936$, $p = .423 > .05$ indicating that undergraduate science process skill is not a significant predictor male and female undergraduate academic achievement in science education courses. The inference drawn was that undergraduate science process skill is not a significant predictor of male and female academic achievement in science education courses.

Discussion
Role of Science Process Skills in Predicting Academic Achievement among Undergraduate Science Education Students.
The findings of the study in Table 1 reveals a low positive predictive value between Undergraduate students' science process skills (USSPS) and their academic achievement in science education courses. Thus, undergraduate science process skills (USSPS) is not a significant

predictor of their academic achievement in science education course in Table 3. The above findings are not in consonance with that of Obikezie et. al. (2025a) who observed a high prediction between urban secondary school students' science process skill and their academic achievement in senior secondary school science subject but inline the authors no significant differences report between the variables. It is also not in line with Abumchukwu et. al. (2024) reported a high correlation between science process skills and secondary school Chemistry students' attitudes and achievement in emerging technology but in line with authors no significant different observation between the two variables of study.

However, the study is in consonance with Umeji and Achufusi (2025a) who reported that low positive predictive value exist between students' science process skills and secondary school students' academic achievement in Physics with no significant different between the two variables of interest. The low positive predictive value between Undergraduate students' science process skills (USSPS), undergraduate students' academic achievement and no significant difference in prediction between USSPS and achievement may have come as a result of varied learning styles, assessment methods, or curriculum misalignment use in teaching science education courses to undergraduate science education students. By the virtue of the above findings, the study has joined group of scholars that observed low positive predictive value between Undergraduate students' science process skills (USSPS), undergraduate science education students' academic achievement and no significant difference in prediction between USSPS and achievement.

Science Process Skills as Predictors of Academic Achievement in Male and Female Undergraduate Science Education Students
The findings of the study in Table 2 show that a low positive predictive value exist between undergraduate students' science process skills (USSPS) and their academic achievement as moderated by gender in science education courses. Thus, undergraduate science process skill is not a significant predictor of the academic achievement of male and female undergraduate students in science education courses in Table 4. The findings above is in line with Umeji and Achufusi (2025a) who reported that low positive predictive value exist between students' science process skills and academic achievement of male and female secondary school students in Physics. However, students' science process skills are not significant predictors of the academic achievement of male and female secondary school students

in Physics. The findings above are also in agreement with Abumchukwu et. al. (2024) who reported no significant different between secondary school students science process skill and their academic achievement in Chemistry not minding the gender differences. Also the findings are in consonance with Umeji and Achufusi (2025b) who reported no discernible effect on either male or female students, discovered a minimal positive predictive value between the academic achievement of secondary school students in Physics and the quality of their teachers. The low positive predictive value that exist between undergraduate students' science process skills (USSPS), male and female undergraduate students academic achievement and no significant prediction value in variables involved as moderated by gender in science education courses could be as a result of differences in study habits, motivation levels, teaching methods and assessment biases. By the virtue of these findings and report, the study has joined the group of scholars who reported that low positive predictive value exist between undergraduate students' science process skills (USSPS), male and female undergraduate students academic achievement and no significant prediction value in variables involved as moderated by gender in science education courses.

Recommendations
Based on findings could be suggested that future studies should explore integrating diverse teaching strategies that cater to different learning styles and genders especially in high institutions. Enhancing students' science process skill assessments and including longitudinal data could provide deeper insights. Additionally, implementing targeted interventions to develop critical thinking and practical application skills may strengthen the relationship between USSPS and academic achievement in science education courses for all students.

Conclusion
Based on the investigation into undergraduate students' science process skills as predictor of academic achievement in science education courses it can be concluded that a low positive predictive value exist between Undergraduate students' science process skills (USSPS) and their academic achievement in science education courses. However, undergraduate science process skills (USSPS) is not a significant predictor of their academic achievement in science education course. More so, a low positive predictive value that exist between undergraduate students' science process skills (USSPS) and their academic achievement as moderated by gender in science education courses. Thus, undergraduate science process skill is not a

significant predictor of the academic achievement of male and female undergraduate students in science education courses

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