



Self-Concept, Locus of Control, and Study habits as Predictors of Physics Achievement among Senior Secondary School STEM Students in Nsukka Education Zone, Enugu State, Nigeria

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Abstract

The study assessed the contribution of academic self-concept, locus of control, and study habits to achievement in physics among senior secondary school students in Nsukka Educational Zone in Enugu State, Nigeria. Two research questions and two corresponding hypotheses were formulated for the study. A predictive correlational research design was adopted for the study. A sample of 290 Senior Secondary Two (SS2) students was selected using a multi-stage sampling procedure. Four research instruments (the Physics Students' Self-concept Questionnaire (PSSQ), Physics Students' Locus of Control Questionnaire (PSLCQ), Physics Students' Study Habits Questionnaire (PSSHQ), and Students' performance in Physics Proforma (SAPP)) were used for data collection in the study. The PSSQ, PSLCQ, and PSSHQ were adapted while the SAPP was developed by the researchers. The instruments underwent face and content validity testing, with each item having a high content validity ratio ($CVR \geq .85$). The PSSQ, PSLCQ, and PSSHQ were subjected to a reliability test using Cronbach's alpha formula. The reliability indices were all acceptable: PSSQ, $\alpha=.81$, PSLCQ, $\alpha=.76$, and PSSHQ, $\alpha=.82$. The data obtained were analyzed using the Statistical Package for the Social Sciences (SPSS) version 25. Multiple regression analysis was used to determine the joint contribution of the predictors to academic achievement in Physics. Standardized beta coefficients (β) were used to determine the relative contributions. The findings showed that the predictor variables made a statistically significant composite contribution to students' achievement ($R^2 = 0.31$, $p = .001$). Relatively, study habits ($\beta=.52$, $p=0.001$) had the highest and most significant contribution to students' achievement, followed by non-significant self-concept ($\beta=.07$, $p=.20$) and locus of control ($\beta=.02$, $p=.69$). These findings highlight the need for teachers and school counselors to design workshops focused on time management and distraction reduction, as developing good study habits yields far greater academic gains in Physics than merely fostering a positive self-concept or internal locus of control alone.

Keywords: Academic Achievement, Academic Self-Concept, Locus of Control, Physics, Senior Secondary School Students, Study habits.

Introduction

Globally, Physics is an indispensable discipline needed for technological innovation and industrialization, energy security and sustainability, health care and medical technology, transportation and communication, and national security and defense. Nigeria recognizes the relevance of Physics for national development and prioritizes teaching and learning of Physics through secondary to tertiary

education. Nevertheless, student performance in Physics at the secondary school level has continued to be significantly low in spite of the relevance of the subject, highlighting a threat to Nigeria's technological development. The past decades, although they have witnessed a significant surge in research data regarding the link between psychological factors and achievement, little is known

regarding the individual and combined relationship among academic self-concept (SC), study habits (SH), and locus of control (LoC) and Physics performance.

Physics deals with both abstract and concrete concepts. Physics is defined as a science of nature that studies energy and matter and their interactions with each other (Akinbobola & Bada, 2019). It is the science that allows individuals to understand natural phenomena at both microscopic and macroscopic levels (Mantegna, 2024; Imanova, 2022). This natural phenomenon includes issues related to motion and mechanics, electromagnetism and light, astronomy and cosmology, and quantum and nuclear physics. Hence, Physics is regarded as fundamental for understanding the complexities of modern technology (Ragini, 2023). The importance of Physics is evident, as it can equip students with basic skills to be self-employed. In the modern era of science and technology, Physics education is considered a key factor driving technological advancement for effective living (Bawan *et al.*, 2024). Evans *et al.* (2013) noted that Physics is very relevant to the extent that it triggers the deepest fears and highest hopes for the future of humankind. The fear is due to the role of Physics in the development of weapons such as atomic bombs.

For Nigeria to become technologically independent, secondary education needs to lay an adequate foundation for future scientists' growth. Essentially, Physics is made a prerequisite subject by the Joint Admissions and Matriculation Board for admitting students into engineering, pharmacy, nursing, medicine, and other related fields in Nigerian tertiary institutions. This implies that the chance of students enrolling in these professions depends on their success in Physics. However, Nigerian secondary school students' performance in Physics remains low despite the importance of Physics (Onah, 2023). Students still struggle to learn Physics and this may be attributed to students' wrong perception of Physics as an abstract subject that is challenging to understand (Evans *et al.*, 2013). Recent studies indicated that students' learning difficulties in Physics occur mostly in the form of (i) misconceptions present in the statement of the problem, (ii) misreading and/or misconception of questions posed, (iii) weak mathematical ability of the students, and (iv) confusion in understanding terminology (Khan & Saeed, 2021). The WAEC Chief Examiners' reports

(2019-2024) revealed that students' weaknesses in Physics include limited knowledge about optical fibers, semiconductors, binding energy, interpretation and application of velocity-time graphs, inability to define terms in Physics, and careless omission of units of quantity in final answers. The 2025 WAEC chief examiner also reveals performance dropped, with reports indicating a significant decline and low pass rates (roughly 39.30% in some regions). The report also highlights a decline in physics performance, with many candidates struggling with application-based questions, mathematical problems, and core concepts. Other weaknesses include the inability of students to express numbers in standard form, poor handwriting, and the inability to distinguish between terms such as "explain" and "define" in questions. These weaknesses and the persistently poor academic performance in Physics have negative impacts on both individuals and nations.

In the first place, the direct outcome of poor performance of students in Physics is the low enrollment of students and a shortage of experts in science-related fields. This would indirectly lead to inadequate manpower needed to reposition the nation economically and technologically. Lack of this manpower would further lead to over-dependence on other nations for food, equipment, job opportunities, funding, and other resources. It is worth mentioning that while teachers' instructional materials, subject nature, interest, and motivation contribute to low enrollment in science (Ragini, 2021), students' related factors also account for poor achievement in the subject. Emerging evidence, however, suggests that students' performance in Physics is positively related to their academic self-concept (Jaiswal & Choudhuri, 2017).

Given the relevance of Physics for national development, it is very essential to understand factors that are related to students' achievement in Physics. Specifically, three variables—self-concept, LoC, and SH; are the focus of this study because of their tripartite link to academic performance. Given the possibility that a student might have a positive self-concept (believing they are smart) and an internal LoC (attributing success and failure to their actions), but without good SH, their academic performance will still suffer. There is a need to investigate both the individual and combined contribution of three factors to students' performance in Physics.

Literature Review

Impact of Self-concept on Academic Achievement

Different students have different views about themselves when it comes to academic-related tasks. These perceptions impact the level of learning for these individuals. To participate effectively in the classroom, students are expected to maintain a strong academic self-concept, which includes their internal evaluations of their intellectual potential and academic strengths (Onah, 2023). In the context of Physics, self-concept denotes a student's confidence in their ability to finish tasks related to the subject. Although studies consistently demonstrate that having a positive self-concept is associated with higher achievement (Febriana et al., 2019), these studies frequently have limited scope. For instance, Ilo, Ezeliarah, and Okafor (2025) reported that self-concept has a significant predictive influence on Physics' students' achievement. It is worth noting that Ilo, Ezeliarah, and Okafor only focused on students' achievement in wave-related Physics concepts, thereby limiting the scope of the findings. Unlike Ilo, Ezeliarah, and Okafor (2025), achievement in the present study was measured by average scores students obtained in first, second, and third terms of annual physics examinations. Olanrewaju and Obidinma (2025) found a significant relationship between self-fulfillment and the achievement of female students in Plateau State, Nigeria. While the findings of Olanrewaju and Obidinma (2025) are relevant to the present study, they are limited in scope in that only female students participated in the study. A significant link between self-concept and academic performance in Basic Science in Yola was also reported (Shaibu, 2025). Although Basic Science and Physics are related, the findings on Basic science may not be automatically applied to Physics because of the difference in curriculum. Moreover, while considerable literature exists on the influence of self-efficacy on achievement (Onah, 2023; Ajmal & Rafique, 2018), few studies have investigated the influence of self-concept on students' achievement in Physics, especially in Nigeria. Additionally, little is known about the combined predictive power of self-concept, LoC, and SH on students' achievement in Physics.

Study habits and Academic Achievement

No student can learn effectively without developing good study habits (SH). According to Almusharraf (2021) and Putwain et al. (2023), SH denote the intentional learning techniques and behavioral patterns students employ to gain knowledge, and they remain crucial for academic success in increasingly digital learning environments. Studies have revealed a significant relationship between university students' CGPA (Hensley et al., 2021), academic performance Abubakar, Attahiru and Aliyu (2026) and effective habits like prioritizing difficult material, keeping a quiet study space, and conducting regular reviews. At the junior secondary school level, there is a significant relationship between SH and performance in Basic science Obodo, (2025). It can be deduced that the influence of SH on academic performance cuts across all levels of education (Nurtamam et al., 2023). Researchers have recognized the link between SH and academic performance and noted that underperformance in academics is attributed to SH (Ahmad & Soria, 2022). Despite the growing interest in the link between SH and academic outcomes, empirical evidence regarding the specific and joint contribution of SH, LoC, and self-concept to secondary school students' achievement in Physics is still lacking.

Locus of Control and Academic Achievement

A student-centered learning approach demands that students be able to take control of their learning. Academic LoC is not a new term in education. It was first introduced by Rotter (1966) to describe individuals' perception of their control over occurrences in their environment. It is defined as the strength of an individual's beliefs in the amount of control they have over life-affecting situations and experiences (Okeke & Ukoh, 2020). Academic LoC is an individual characteristic that determines the degree to which an individual believes they control life events (Chinedu & Nwizuzu, 2021). In this study, academic LoC is the students' belief that they are responsible for their academic progress or failures, even as they take credit for their successes. The influence of academic LoC on academic performance depends on whether it is internal or external (Ellah & Ewah, 2023).

While internal academic LoC is the belief that individuals are responsible for their academic success as well as their failure, individuals with an external

academic LoC typically find excuses for their failure, even as they take credit for their success. Students who possess an external academic LoC may attribute their poor achievement to various factors, such as the nature of the subject, the examination invigilators, the inability of their parents to provide their needs, and other factors (Okeke & Ukoh, 2020). Academic LoC is developed during childhood and becomes obvious at the adolescent stage, often nurtured by the environment, experience, culture, and religion (Onah & Nnadi, 2023).

The relationship between students' internal academic LoC and academic achievement in various school subjects and locations has been explored substantially. For instance, in a mixed-ability Physics classroom, students' academic LoC had significant predictive power on students' ability level (Ellah & Ewah, 2023). Secondary school students' academic LoC also influences their academic performance (Okeke & Ukoh, 2020). The influence of academic LoC on the achievement of secondary school students in Mathematics, English, and Christian religious knowledge was found to be significant (Chinedu & Nwizuzu, 2021). Moreover, Atibuni et al. (2017) found a negative and significant relationship between attitudes towards learning and external academic LoC. External academic LoC also had a negative relationship with students' academic performance (Atibuni et al., 2017; Animba et al., 2022; Arsini et al., 2023). These highlighted studies, although indicating the relationship between academic LoC and academic outcomes, raise the question of whether academic LoC, SH, and self-concept would jointly predict students' achievement in Physics.

To assess the individual, joint, and relative contributions of self-concept, SH, and LoC to students' performance in Physics requires the use of multiple regression analysis. A multiple regression analysis allows a researcher to examine the predictive relationships among three or more variables. Given the limited information on the joint and relative contributions of self-concept, SH, and LoC to students' performance in Physics, there is a need to explore these relationships among these variables.

Research Questions

1. What is the joint contribution of academic self-concept, academic LoC, and SH to

secondary school students' academic achievement in Physics?

2. What is the relative predictive contribution of academic self-concept, academic LoC, and SH to senior secondary school students' academic achievement in Physics?

Hypotheses

- H₀₁: There is no significant joint predictive power of academic self-concept, academic LoC, and SH secondary school students' academic achievement in Physics?
- H₀₂: There is no significant relative predictive contribution of each of academic self-concept, academic LoC, and SH to senior secondary school students' academic achievement in Physics.

Theoretical Framework of the Study

Grounded in Bandura's (1986) Social Cognitive Theory, this research utilizes the concept of triadic reciprocal causation to explain how learning occurs through a continuous interplay between personal cognitive factors, individual behavior, and the surrounding environment. Under this perspective, students act as self-directed and proactive agents who actively shape their own learning, rather than merely reacting to environmental influences. Applying this theory to performance in Physics, students' cognitive attributes, specifically their self-concept and LoC, serve as internal personal determinants that shape their observable SH, which ultimately have a link to their physics achievement.

Central to Bandura's theory is the role of self-beliefs in driving action, where a student's academic self-concept reflects their self-evaluation of competence in specific domains like physics. Furthermore, Bandura's concept of human agency aligns closely with LoC, determining whether students believe their academic outcomes are a result of their actions or external forces, meaning students with an internal LoC are more likely to exercise personal agency and take active responsibility for adopting effective learning strategies. Moreover, habits represent self-regulation, suggesting that students who

possess a strong internal framework and positive self-beliefs could better structure their study environments, manage their time, and employ cognitive strategies. This theory highlights the link between the predictor variables and achievement in physics.

Methodology

Design and Area of the Study

This study's research design is based on a predictive correlational research design, which is specifically used to ascertain the type and strength of relationships between different factors, according to Ogbu (2025). Because the study aims to examine the predictive contribution of three independent variables (academic self-concept, LoC, and SH) on the dependent variable (academic achievement in Physics), this method was judged to be the most appropriate. The “Nsukka Education Zone in Enugu State, Nigeria”, is where the investigation was carried out. There are 62 public secondary schools in this zone spread over three Local Government Areas (LGAs): 32 in Nsukka, 15 in Igbo-Etiti, and 15 in Uzo-Uwani. This region has a diverse economic landscape and is primarily home to people of Igbo descent. While many residents work in business and commerce, others are employed as artisans, farmers, or civil servants. Many students and recent graduates looking to enter the workforce also constitute a significant number of the residents. This area was chosen because a considerable number of students in this area perform poorly in Physics as evident in the school records of students' annual results in Physics examination.

Participant

The study's population consisted of 1200 Senior Secondary Two (SS 2) Physics students in “Nsukka Education Zone”. In accordance with the statistical standards set by Cohen, Manion, and Morrison (2007) for a population of this size, 290 students were selected as a sample from the population. A multi-stage sampling procedure was used to guarantee a reliable selection process. In the first place, using simple random sampling and balloting without replacement, two of the three LGAs were drawn. Secondly, schools in those LGAs that continued to enroll at least 25 SS 2 Physics students was drawn using purposive sampling. Thirdly, from the 20 schools that met the criteria in the previous step, 13 schools were selected through balloting. Finally, a

total of 290 SS2 Physics students were found in the 13 schools and they constituted the sample for this study.

Measures

Four research instruments were deployed to elicit responses from the participants, namely, Physics Students' Self-concept Questionnaire (PSSQ), Physics Students' Academic LoC Questionnaire (PSLCQ), Physics Students' Study Habits Questionnaire (PSSHQ), and Students' Academic achievement in Physics Proforma (SAPP). The first instrument, PSSQ encompassed three dimensions; self-image, ideal-self, and self-esteem. The PSSQ was adapted from Flowers *et al* (2013) who used the tool to elicit information on 100 level undergraduate students' academic self-concept in STEM courses. The Flowers *et al* (2013) original instrument comprised of 40 items. In order to make the PSSQ suitable to this present study, some items were rewritten. A total of 40 items formed the PSSQ. The PSSQ was scored on 4-point Likert type scale thus; “strongly agree (SA) =4 point, Agree (A) =3 point, disagree = 2 point, and strongly disagree = 1 point”. Negatively worded items were reverse scored before analysis.

The second instrument is the PSLCQ comprising 33 items and was adapted from Ogbu and Agugoesi (2022) who developed the scale for measuring secondary school students' academic LoC. The original instrument developed by Ogbu and Agugoesi has a total of 33 items in four clusters. The dimension of the PSLCQ comprise internal LoC, external LoC, and general internal LoC, and general external LoC. Modification was made in some of the items to suit Physics students. For instance, item one which initially read “my success in school depends on my efforts and not a matter of being lucky was rewritten to read “my success in Physics depends on my efforts and not a matter of being lucky”. The items were also scored in a 4-point Likert type scale just as the original instrument as follows: “strongly agree (SA) =4 point, Agree (A) =3 point, disagree=2 point, and strongly disagree = 1 point”. Negatively worded items were reverse scored before analysis.

The third instrument (PSSHQ) was adapted from Sakirudeen and Sanni (2017). The authors used the instrument to measure secondary school students' SH. The original instrument comprised 15 items distributed in three dimensions of SH: note taking, use



of library, and time allocation. To make the PSSHQ suitable for this current study, some items were rewritten. For example, item 13 which initially read “I devote extra time to thorough learn a certain subject like Mathematics” was rewritten to read “I devote extra time to thorough learn certain subject like Physics”. The scoring of the PSSHQ was also on a 4-point Likert type scale which is in line with the original scale used by Sakirudeen and Sanni. This 4-point scales are as follows: “strongly agree (SA) =4 point, Agree (A) =3 point, disagree=2 point, and strongly disagree = 1 point”. Negatively worded items were reverse scored before analysis.

The fourth instrument for data gathering in this study is a proforma developed by the researcher and entitled “Students’ Academic achievement in Physics Proforma (SAPP)”. The SAPP contains information such as the students’ class number, first, second, and third term scores in Physics examination. The average score for the three terms represented the students’ achievement in Physics.

Validity and Reliability of the Measures

To establish face validity, the research instruments, along with the research objectives, questions, and hypotheses, were reviewed by a panel of three experts from university of Nigeria Nsukka, Faculty of Education. This panel included specialists in Educational Psychology, Measurement and Evaluation, and Physics Education. These experts evaluated the items for clarity, relevance, and potential ambiguity, offering refinements to improve the instruments' quality. In addition to the face validity, the experts were also asked to rate each item of the questionnaires on their relevance and usefulness using the key; "essential," "useful but not essential," or "not necessary". The computed content validity ratio (CRV) for each item was above 0.85 indicating evidence of content validity. The experts suggestions were reflected in the final version of the instruments.

Through a pilot study involving 30 Physics students from Community Secondary School Ede-Oballa. This school was specifically chosen for trial testing the instrument and was not involved again in the actual study. The school is one of the schools in “Nsukka Education Zone”, implying that it has all the characteristics of other schools used in the actual study. Using Cronbach’s alpha, the internal

consistency for the PSSQ, PSLCQ, and PSSHQ was calculated at 0.81, 0.76, and 0.82, respectively.

Method of Data Collection and Analysis

Three research assistants were hired and instructed on how to properly administer and retrieve the study instruments in order to facilitate data collection. With an introductory letter obtained from the Head of Department, Science Education at the University of Nigeria, Nsukka, the primary researcher and the assistants made initial visits to the participating schools to inform principals and Physics teachers about the study prior to the start of data collection. The principals of the sampled schools were adequately informed about the purpose of the study. They were ensured that the data collected would be kept confidential and used for pure research purposes. The students gave their consent to participate orally as they were informed that participation was voluntary. During the actual data collection, the students were given the PSSQ, PSLCQ, and PSSHQ directly. The school Physics teachers and research assistants helped with the data collection process, making sure that all questionnaires were filled and promptly retrieved on-site.

The collected data were checked for basic regression assumptions prior to formal analysis. First, linearity was verified by inspecting scatterplots of the predictors against the outcome variable and plotting standardized residuals against predicted values. Second, independence of errors was confirmed using the Durbin-Watson statistic, targeting values between 1.5 and 2.5 to rule out autocorrelation. Third, homoscedasticity was checked via the Breusch-Pagan test ($p > .05$) and confirmed visually by an even, non-funneled distribution of residuals across predicted values. Fourth, normality of residuals was examined through Shapiro-Wilk testing alongside visual inspection of Normal Q-Q plots and histogram bell curves. Fifth, multicollinearity was evaluated using Variance Inflation Factor (VIF) and Tolerance metrics, establishing strict cutoff criteria of $VIF < 5.0$ and tolerance > 0.20 . Finally, influential outliers were identified and managed using standardized residuals (retaining observations within 3.0 standard deviations) and Cook’s Distance (ensuring values

remained strictly below 1.0). Multiple imputation was used to fill in any missing data points. Statistical analysis was performed using SPSS (Version 25). Specifically, multiple regression analysis was used to determine the joint contribution predictor variables on the outcome variables. Standardized beta coefficients (β) were used to determine relative the contributions. The (β) was interpreted based on Funder and Ozer

(2019) guidelines thus; trivial ($0.00 \leq \beta < 0.04$), very Small: ($0.05 \leq \beta < 0.09$), low ($0.10 \leq \beta < 0.19$), moderate ($0.20 \leq \beta < 0.29$), and high (≥ 0.30). The level of significance was set at 0.05 for testing the hypotheses. The decision rules were to reject the null hypotheses if obtained level of significance (p-value) is less than the stated p-value, 0.05

Results

Research Question One

Table 1: Multiple Regression Analysis of Self-concept, LoC, and SH on Students' Academic Achievement in Physics

Factor	R	R ²	F	P	Decision
Self-concept, LoC SH <i>Adjusted-R²=0.31, df₁=3, df₂=286</i>	0.56	0.31	43.31	0.001	Significant.

To assess how academic self-concept, LoC, and SH collectively impact Physics performance among secondary students, researchers first verified that the data met all necessary statistical criteria, including linearity, normality, and the absence of multi-collinearity. The analysis revealed a moderate positive multiple correlation ($R = 0.56$) among the three psychological factors and academic performance. Furthermore, the regression model yielded a coefficient of determination of ($R^2 = 0.31$), indicating that these three variables together account for 31% of the total variance in students' Physics achievement while the remaining 69% of the variance is attributable to other factors not included in the model.

Hypothesis One:

Table 1 shows that a significant composite contribution of the three variables to the regression models ($AC = -1000.95 + 0.37(SC) + 0.10(LC) + 1.59(SH)$) on students' achievement in Physics ($F(3,286) = 43.31, p = 0.00 < 0.05$). Since the associated p-value of 0.001 was less than 0.05 level of significance, the null hypothesis one (H_{01}) that there no significant composite contribution of academic self-concept, academic LoC, and SH to secondary school students' performance in Physics was therefore rejected. This implies that as the students' level self-concept, LoC, and SH improve, their academic performance increases substantially.

Research Question Two:

Table 2:

Relative Contribution of Self-concept, LoC, and SH to Students' Academic Achievement in Physics

Model	Unstandardized Coefficients		Standardized Coefficients Beta	t	P	Decision
	B	Std. Error				
(Constant)	-100.95	43.08		-2.34	0.02	
Self-concept	0.37	0.29	0.07	1.29	0.20	NS
LoC	0.10	0.252	0.02	0.40	0.69	NS
SH	1.59	0.17	0.52	9.30	0.001	S

NS=Not Significant, S=Significant,

Before diving into the results, researchers ensured the data was statistically sound by verifying several key regression assumptions; including linearity, and normality. Table 2 presents both unstandardized and standardized coefficients for predicting achievement using self-concept, LoC, and SH. From the Table 2, Study habits were the highest predictor of students' achievement in Physics ($b=1.59$, $\beta=0.52$) followed by self-concept ($b=0.37$, $\beta=0.07$) while LoC was the least ($b=0.10$, $\beta=0.02$). It implies that SH had moderate contribution to students' achievement. On the other hand, self-concept made a very small contribution while LoC had a trivial contribution.

Hypothesis Two:

Table 2 shows the unstandardized and standardized coefficient for the relative predictive contribution of self-concept, LoC, and SH to students' achievement in Physics. The contribution of SH to students' achievement in Physics in relative self-concept and LoC was statistically significant ($b=1.59$, $\beta=0.52$, $t=9.30$, $p=0.00<0.05$). However, there was no significant relative predictive contribution of self-concept ($b=0.37$, $\beta=0.07$, $t=1.29$, $p=0.20>0.05$) and LoC ($b=0.10$, $\beta=0.02$, $t=0.40$, $p=0.69>0.05$) in predicting students' performance in Physics. This findings implies that student can have a wonderful, high academic self-concept and a positive internal LoC, but if they do not have good SH study habit, such as adequate time management, there academic achievement may not meaningfully improve.

Discussion

This research investigated the link between the predictor variables (self-concept, LoC, and SH) and student performance in Physics. The findings demonstrated a significant joint contribution of self-concept, LoC, and SH to achievement in Physics. One possible explanation for this finding is that the variables capture a significant variance in academic performance because they represent a cohesive psychological profile that relates to academic success. When the students believe in their ability, accept their success and failures, and spend more time learning, they are likely to overcome more of their learning challenges, which would reflect on their academic performance. On the other hand, when students have doubts about their ability to tackle academic tasks, they are more likely to attribute their learning challenges to many factors and may not spend significant time trying to learn. The consequences of this interplay could manifest in the form of low academic outcomes. Therefore, it is expected that students who wish to achieve significantly in Physics need to build their self-concept, take responsibility for their learning, and match this up with effective SH.

This finding is consistent with previous research by Onah and Nnadi (2023), who explored the predictive relationship between self-regulation, LoC, and performance in Physics. It was found that self-regulation and LoC jointly predicted students' performance in Physics. The study is also in agreement with Aniba et al. (2022), who detected a significant joint impact of self-concept and LoC on students' achievement in Physics. The study also supported Okeke and Ukoh (2020), who found that a significant relationship exists between LoC and the performance of secondary school Physics students in



Ibadan. The findings also corroborated Atibuni et al. (2017), who reported a significant relationship between LoC and the need for libraries to be well-attuned to the attitudes of science teachers in public secondary schools in Uganda. The study also aligns with Jafari et al. (2023) and Akporehwe and Billy (2018), who discovered that SH was a significant factor in students' performance in science. The reason for these findings on the significant impact of self-concept, LoC, and SH on achievement is that these three variables need to interact for effective learning to occur. This effective learning manifests in terms of students' performance.

A key finding of this study is that the contribution of SH to performance in Physics in relative self-concept, and LoC was statistically significant. This result can be attributed to the fact that a student might have a high academic self-concept, but if they don't actually study, they will fail. Moreover, SH are concrete behaviours (time management, note-taking, consistent revision) unlike self-concept and LoC, implying that even if a student struggles slightly with self-doubt, rigorous, effective SH can directly improve achievement.

The results align well with those reported by Jafari et al. (2023) and Akporehwe and Billy (2018), who discovered that SH were a significant factor in students' performance in science, such as chemistry, Physics, and biology. Students with poor study habits may not engage in meaningful learning and consequently are prone to achieving poorly. Hence, instilling good SH in the students ought to be a collective responsibility for the parents, the teachers, and the school authority. While the teachers, school authority, and the library need to ensure that the library is well equipped and utilized by the students, parents need to provide the students with the learning resources they need. The parents also need to ensure that the students have enough time for their studies.

The findings can be interpreted within the framework of Albert Bandura's social cognitive theory that people learn primarily through observing, modeling, and imitating the behaviors, attitudes, and emotional reactions of others. The teachers need to support students developing positive self-concepts and internal LoC by enabling the students to see that individuals with low self-concepts and external LoC can actually overcome that and attain excellent academic success. The theory also emphasizes the

concept of reciprocal determinism, meaning that an individual's personal traits, their environment, and their behavior all continuously interact to shape one another, highlighting a possible explanation of the joint link between the personal traits (LoC and self-concept) and behavior (SH) and achievement in Physics.

Conclusion

This study revealed the critical roles academic self-concept, LoC, and study habits (SH) play in shaping students' academic achievement in Physics among senior secondary school STEM students in the "Nsukka Education Zone." The findings reveal that while the variables have a significant joint relationship, physics performance and SH emerge as the most potent and decisive predictors of achievement in Physics. Therefore, educational stakeholders need to move beyond merely addressing self-concepts and prioritize practical behavioral interventions, such as structured time management workshops, effective note-taking strategies, and distraction-reduction techniques, as these could directly enhance students' daily academic achievement. Fostering a positive self-concept and encouraging an internal LoC help students build resilience, view academic challenges as manageable, and take personal responsibility for their learning outcomes. Hence, STEM educators should integrate these cognitive-behavioral strategies directly into classroom instruction for effective learning outcomes. Through the combination of Physics instruction with explicit training in effective learning habits and self-regulation, secondary schools can better equip STEM students to overcome persistent learning hurdles and significantly improve their overall performance.

Educational Implications of the Study

The findings of the study have several practical educational implications for students, teachers, parents, school administration, guidance and counselors, and government at all levels. The findings of the study also have theoretical education implications for Bandura's social cognitive theory. The findings on the joint relationship among the predictors and students' achievement in physics imply that when students are aware of the roles of their SH, self-concept, and LoC in their academic performance, they are likely to improve their SH and develop a

better self-concept and internal LoC, which would in turn enhance their academic performance. This means that students can easily recognize the importance of appreciating and engaging in activities that enhance their academic self-concept, having understood the connection between these variables and their academic performance.

The findings of the study further imply that for physics teachers to teach some difficult content areas in Physics, they need first to ensure that students develop effective SH and positive self-concept necessary to internalize the expected learning experiences. This means that simply testing students' entry behavior before teaching may not be sufficient; teachers must also work to enhance students' learning confidence and self-concepts to promote effective self-handling. Through this approach, the reoccurring poor achievement in Physics could be put to an end.

Similarly, while the students spend a large amount of their time in the schools, it is expected that the home environment should complement the efforts of the school in changing the students' behaviour. Hence, the findings on the positive link among self-concept, LoC, SH, and achievement imply that parents have a strong role to play in encouraging their children to develop the needed self-concept and SH for effective learning. This means that, at home, parents need to continue the work of teachers by inspecting their children's assignments and ensuring that the children do not use their study time for non-academic activities. In other words, the home environment should be planned to facilitate learning, especially for the younger students who may find it difficult to learn independently.

The finding of the study has relevant implications for the school administrators. They could see the need to utilize these findings to facilitate students' learning by enacting and ensuring that policies are geared towards identifying and remediating students' negative self-concept, poor SH, and external LoC. Through this approach, struggling students would easily overcome their learning challenge, which would result in better academic performance. While the teachers, parents, and school administrations have a significant role to play when it comes to enhancing academic performance, the school guidance and counselors are duty-bound to diagnose and remediate students' psychological factors such as poor self-concept and negative LoC, which could

negatively impact learning. Hence, the findings imply that the school guidance and counselor need to be proactive so as to easily detect students with negative self-concepts, poor SH, and external LoC and apply necessary corrective measures. Through the timely intervention of these stakeholders, students' learning challenges These stakeholders can easily help students overcome their learning challenges through timely intervention. overcome.

Nigerian public schools are within the control of either the state or the federal government. Hence, the findings on this are worthy of spurring the government's interest in making policies and programs necessary to facilitate students' development of positive self-concept, internal LoC, and good SH. Through the findings, the government could also see the need to recruit more guidance and counselors and improve the quality of the school libraries. The long term of these interventions would result in effective learning and improved achievement.

The findings also have implications for Bandura's social cognitive learning, which is that people learn primarily through observing, modeling, and imitating the behaviors, attitudes, and emotional reactions of others. In this context, students who have negative self-concepts and LoC may be guided by the teachers through encouragement to develop better self-concepts and internal LoC.

Limitations and Direction of Future Researches

The interpretation of the findings of the study needs to consider several limitations. The finding of the study indicated that self-concept, LoC, and SH individually and jointly contributed to students' performance in Physics. While these findings are relevant, it is worth stating that they do not imply that self-concept, LoC, and SH are the cause of students' performance. Hence, these findings need to be interpreted with caution. Therefore, a similar study on the effect of self-concept, LoC, and SH on students' performance in Physics could use longitudinal, mixed-method, or structural equation modeling approaches.

The study was conducted using SS2 Physics students in "Nsukka Education Zone." The findings obtained using these respondents may not be generalized to a larger population beyond the ones used for the actual study. A larger sample size across different levels of students. To provide more generalizable findings, researchers may need to use a



larger sample size across different levels of students. Researchers may need to use a larger sample size across different levels of students to provide more generalizable findings. Secondly, the findings may not be applied to non-science students such as those in arts and humanities. A similar study on the predictive impact of self-concept, LoC, and SH on students' performance in Physics could be conducted using both SSI, SS2, and SS3 students in a wider geographical location, such as the entire Enugu State.

The achievement of students in Physics was measured using the students' academic record for the 2023/2024 academic session. The findings of the study may vary depending on the academic session of the students involved on the academic session of the students in the study. Longitudinal studies on the impact of self-concept, LoC, and SH on students' performance in different subjects, spanning different academic sessions, need to be conducted.

The relative significance of the contribution of SH over the self-concept and LoC Interpreting the relative significance of SH's contribution over self-concept and LoC requires considering these three variables. in the light of these three variables. In other words, with different variables or with more variables, SH may not be the major contributor to the students' performance in Physics. A similar study needs to be conducted to examine the relative contribution of self-concept, LoC, SH, motivation, interest, and teachers' support to students' performance in Physics

Recommendations

The study's findings led to the following recommendations:

1. Students with poor SH, low self-concept, and external LoC should be encouraged by their teachers and parents to overcome these shortcomings.
2. Governments should build and equip school libraries with current textbooks in order to enhance students' SH.
3. Government should recruit more guidance and counselors who should be saddled with the responsibility of identifying students who struggle to learn and remediating their learning challenges.
4. Government should organize workshops for teachers and school administrators on how to identify students with poor SH and low self-

concept and how to apply necessary corrective measures.

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