



Self-regulation and Self-perception as Predictors of Secondary School Students' Academic Achievement in Chemistry in Obollo Afor Education Zone of Enugu State

Ezugwu Emmanuel & F. E. Ikeh

Department of Science Education, University of Nigeria Nsukka

Corresponding Author: elochukwu.ikeh@unn.edu.ng

Abstract

This study examined self-regulation and self-perception as predictors of secondary school students' academic achievement in chemistry in Obollo Afor Education Zone of Enugu State. Four specific purposes and corresponding four research questions guided the study with four hypotheses tested at 0.05 alpha level of significance. The study adopted correlational research design. A sample size of 349 was drawn from a population of 2746 secondary school students (SS II) from Obollo Afor Education zone of Enugu state. The data generated for the study were obtained using Students' Self-Regulation Questionnaire (SSRQ), Students' Self-Perception Questionnaire (SSPQ) and Chemistry Achievement Test (CAT). SSRQ and SSPQ were face validated by four experts while the validity of Chemistry Achievement Test (CAT) was established using table of specification. The reliability indices of SSRQ, SSPQ and CAT were 0.80, 0.72 and 0.78 respectively. The data collected were analyzed using simple linear regression and multiple linear regression where the null hypotheses were tested using regression t-test and regression analysis of variance. The result revealed that the predictive power of self-regulation on secondary school students' academic achievement in chemistry was significant. It was also found that the predictive power of self-perception on secondary school students' academic achievement in chemistry was significant. It was further found that the joint predictive power of self-regulation and self-perception on secondary school student's academic achievement in chemistry was significant. The study concluded that self-regulation and self-perception are not only significantly related to students' academic achievement, but they are good predictors of students' academic achievement. The researcher recommended among others, that government, secondary school administrators and chemistry teachers should prioritize the integration of self-regulation and self-perception practices into educational interventions by providing an ongoing and adapting instructional behavior on self-regulation and self-perception.

Keyword: Self-regulation, Self-perception, chemistry, academic achievement

Introduction

Self-regulation and self-perception are important factors in the field of education as they play a crucial role in learning processes and in achieving learning goals. When there is a deficiency in the awareness and understanding of how self-regulation and self-perception influence academic performance among secondary school students and teachers, it creates a critical gap in education. This hampers the teachers' ability to offer focused guidance that addresses the individual needs of students and in turn, leads to the underdevelopment of self-regulation and self-perception abilities among secondary school students, which can negatively impact their academic

success. There is lack of proper development and understanding of self-regulation and self-perception skills among secondary school students (Hassan, Ali & Amour 2017). These highlight the need for more research on the role of self-regulation and self-perception on academic achievements of secondary school students, especially in subject like chemistry.

Self-regulation help students to set goals, achieve self-monitoring, regulate behavior and manage time thereby enhancing their academic success. Self-regulation as a multidimensional construct includes the regulation of emotion, cognition, and behavior" (McClelland, 2018). Self-

regulation encompasses all the purposeful actions, monitored and sustained by the learner, to achieve learning goals (Zimmerman, 2013). Self-regulation is an important skill needed by the students to regulate their own learning activities. Many students waste most of their time on social media, playing, watching movies, among others instead of studying. These actions can impact on students' academic success as it can lead to distractions, procrastination, and then poor academic performance. Social media use consumes students' attention and reducing their ability to focus on important tasks (Abbas, Aman & Bano, 2019). Hence, students that exercise self-regulation will be able to overcome time wastage and distraction through self-monitoring, time management and concentrating on their academic activities thereby, enhancing their academic success. Although there are researches that highlight the significance of self-regulation on academic performance of students, it was unknown the type of interaction between self-regulation and secondary school students' academic performance in chemistry in Obollo Afor Education Zone. This highlight the need for a localized research, considering the WAEC Chief Examiners' reports which have revealed repeatedly that student perform low in chemistry and also, the assessment records of students in Obollo Afor Education Zone that reflect the same pattern of poor academic performance in chemistry. However, students are more likely to develop adequate self-regulation when they sustain the right self-perception which furnishes them with awareness about themselves.

Self-perception helps students to select the right behavior activities to engage in. Self-perception refers to how individuals perceive their own personality, abilities and beliefs about their potential for success (Drüsedau, Götz & Barth et al., 2023). Self-perception of students has become a topic of concern with the emergence of digital social media and the increasing amount of time that students spend on social media coupled with peer pressure and societal expectations. On social media and outside social media, students are often exposed to fake peers' lifestyles and fostering unrealistic comparisons which pose potential distortions to students' self-perception as students try to conform to certain standards, appearance ideals, or lifestyle choices, which can detrimentally impact their self-perception and then their academic achievement.

Positive self-perceptions help students to select and engage in academic tasks, set right goals,

and persist in the face of challenges. Students who perceive themselves as competent and capable are more likely to persist in challenging academic tasks and achieve better grades while a negative self-perception can lead to lower levels of academic motivation, engagement, and achievement (Marsh, Martin & Craven, 2017; Drüsedau, Götz & Barth, 2023). This is because students who perceive themselves as incompetent or unworthy may avoid challenging academic tasks, leading to poor grades and low academic achievement. While some existing research establishes a positive correlation between self-perception and academic achievement (Marsh, Martin & Craven, 2017; Ortega-Torres, Solaz-Portoles & Sanjosé-López, 2020), it was unknown the nature of relationship between students' self-perception and their chemistry achievement in this education zone. This underscores the need for localized research to inform targeted intervention.

Chemistry is a key subject for senior secondary school students who plan to pursue a career in science. The subject is designed to equip students with foundational knowledge in scientific concepts and practical skills (Hadinugrahaningsih, Rahmawati & Ridwan, 2017). Chemistry prepares learners for various scientific disciplines, providing the education background required for future vocations (Hardy, Sdepanian & Wright, 2021). Due to the relevancy of chemistry, it has many uses in humans' daily lives and scientific development such as medicine, biochemistry, pharmacy, among others. Humans could barely survive without these scientific disciplines as they provide the knowledge for scientists to solve life problems in the society. The advancement and application of science and technology bring about new inventions, innovations and growth in a society (Aladejana & Fatoba, 2022). Therefore, obtaining high academic achievement in chemistry at the secondary level is essential for preparing students for advanced studies and careers in scientific fields like engineering, food science, medicine, biochemistry, pharmacy, microbiology, and more. It is within this context that high academic achievement in chemistry becomes a pivotal achievement, reflecting students' capability to successfully complete scientific tasks which would prepare them for future career success in science.

Achievement refers to successfully accomplishing something, through effort, determination, and skill, to attain a goal or reach a milestone. According to Maehr (2017), achievement is

accomplishing something, especially by superior abilities, special effort, and great courage. Meanwhile, academic achievement refers to students' performance and success in their academic pursuits during a learning period. Firman, Mirnawati and Aswar (2020), describes academic achievement as all knowledge, skills and all idea acquired by students. In this study, academic achievement is the students' performance outcomes in the intellectual domains related to chemistry taught at the secondary school level. Academic achievement as a measure of learning outcome is an indicator of future career success, scientific innovation, industrial, scientific, technological advancement of a society or nation.

Unfortunately, recent reports indicate that students' academic achievement in chemistry falls short of the standards necessary for driving national progress in science and technology. Data from the West African Senior School Certificate Examination chief examiner report reveals that students' chemistry scores have consistently been below expectations, with mean achievement scores of 54, 45 and 34 for the years 2020, 2022, and 2023 respectively. This data highlight a persistent issue with low academic achievement which is unsatisfactory and underscores the need for further investigation. In addition to the WAEC Chief Examiners' report, school assessment records in Obollo Afor Education Zone reflect the same pattern of poor academic performance among chemistry students. Many researches have been conducted to solve this problem of poor academic achievement in chemistry. A poor method of instruction (Sithole, Chiyaka & Kibirige, 2017); lack of instructional materials (Olufemi, Adediran & Oyediran, 2018) and overloaded syllabus (Kanapathy, Lee & Mohd Zahidi, 2019). Despite various efforts to address this ongoing challenge, the problem of underperformance in chemistry among secondary school students has persisted maybe because the intervention programs are outside the learner. This has raised questions about the possible cause of poor chemistry achievement among secondary school students. According to Hassan, Ali & Amour (2017), there is a lack of proper development and understanding of self-regulation and self-perception skills among secondary school students. Poor self-regulatory skills such as poor time management, lack of control and monitoring of emotions and behavior, poor self-image and negative self-perception which can lead to poor academic achievement. Thus, this issues in self-regulation and self-perception of

secondary school students and the persistent poor academic achievements calls for more studies to inform targeted intervention. It is on this note that this study was premised, to examine the predictive power of self-regulation and self-perception on secondary school students' academic achievement in chemistry.

Research Questions

1. What is the predictive power of self-regulation on students' academic achievement in Chemistry?
2. What is the predictive power of self-perception on students' academic achievement in Chemistry?
3. What is the joint predictive power of self-regulation and self-perception on students' academic achievement in Chemistry?

Hypotheses

- H₀₁:** There is no significant predictive power of self-regulation on students' academic achievement in chemistry.
- H₀₂:** There is no significant predictive power of self-perception on students' academic achievement in chemistry
- H₀₃:** There is no significant joint predictive power of self-regulation and self-perception on students' academic achievement in chemistry.

Methods

Correlational survey research design was adopted for this study with the population of 2746 SS II Chemistry students in the 50 public secondary schools in Obollo Afor education zone of Enugu State. A sample size of 349 Senior Secondary II (SS II) chemistry students was determined using the Taro Yamane formula and selected through a multistage sampling procedure. Three instruments developed by the researcher were used for data collection: Students' Self-Regulation Questionnaire (SSRQ), Students' Self-Perception Questionnaire (SSPQ) and Chemistry Achievement Test (CAT) which consist of 40 items. SSRQ and SSPQ respectively contain 20 items. SSRQ and SSPQ are modeled on four-point likert scale, SA (4), A (3), D (2), SD (1) that represents Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD) respectively. The instruments SSRQ, SSPQ and CAT were face-validated by four experts. Three from the Department of Science Education, two from Research, Measurement and Evaluation unit, one from Chemistry Education unit

and one from Education Psychology, all from the Faculty of Education, University of Nigeria, Nsukka. The content validity of the CAT was determined using the table of specification. The Cronbach's Alpha reliability method was used to determine the internal consistency of SSRQ and SSPQ with reliability indices of 0.80 and 0.72 respectively. Kuder-Richardson 20 method was used to determine the internal consistency of CAT with a coefficient of 0.78 obtained.

Simple linear regression was used to answer research questions 1 and 2, while multiple linear regression analysis was used to answer research question 3. Coefficient of determination (R^2) was used to determine the predictive power of self-regulation and self-perception on students' academic

achievement in chemistry. Hypotheses 1-2 were tested using regression t-test at a 0.05 level of significance while hypothesis 3 was tested using regression analysis of variance. Correlation coefficients (r) between 0.00 - 0.19 was interpreted as very weak relationship, 0.20 -0.39 was considered weak relationship, 0.40 -0.59 was considered moderate relationship, 0.60 -0.79 will be considered strong relationship while 0.80 - 1.00 was considered very strong relationship (Evans, 1996).” In determining the significance of the relationship in all the null hypotheses, where the exact probability value (p-value) obtained was less than the level of significance (0.05), the null hypothesis was rejected, otherwise, not rejected.

Results

Table 1: Linear regression analysis of the predictive power of self-regulation on secondary school students' academic achievement in Chemistry

Model	N	R	R^2	Adjusted R^2
1	349	0.639	0.408	0.407

R =Correlation coefficient, R^2 =Coefficient of determination

The result in Table 1 shows the predictive power of self-regulation on secondary school students' academic achievement in chemistry. The correlation coefficient 0.639 shows that there is a strong positive relationship between self-regulation and secondary school students' academic achievement in chemistry.

Furthermore, the coefficient of determination (R^2) 0.408, shows that 40.8% variation in secondary school students' academic achievement in chemistry can be attributed to students' self-regulation.

Table 2: Regression t-test of the predictive power of self-regulation on secondary school students' academic achievement in chemistry.

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
1 (Constant)	8.948	2.344		3.817	.000
SSR	.801	.052	.639	15.472	.000

The result in Table 2 shows the t-test analysis associated with linear regression of the predictive power of self-regulation on secondary school student's academic achievement in chemistry. The result shows that a t-value is significant ($t=15.472$, $p=0.00$). The associated probability of 0.000 is less than the 0.05 level of significance at which the hypothesis was tested. Hence, the null hypothesis, which stated that there is no significant predictive power of self-

regulation on secondary school students' academic achievement in chemistry, is rejected. The inference drawn is that the predictive power of self-regulation on secondary school student's academic achievement in chemistry is statistically significant and implies that students' self-regulation can be used to predict academic achievement of secondary school students in chemistry.”

Table 3: “Linear regression analysis of the predictive power of self-perception on secondary school students’ academic achievement in chemistry

Model	N	R	R ²	Adjusted R ²
1	349	0.557	0.310	0.308

R=Correlation coefficient, R²=Coefficient of determination

The result in Table 3 “shows the predictive power of self-perception on secondary school students’ academic achievement in chemistry. The correlation coefficient(R) 0.557 shows that there is moderate positive relationship between self-

perception and secondary school students’ academic achievement in chemistry. Also, the coefficient of determination (R²) 0.310 shows that, 31% variation in secondary school students’ academic achievement in chemistry is attributed to their self-perception.

Table 4: Regression t-test of the predictive power of self-perception on secondary school student's academic achievement in chemistry

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	13.699	2.522		5.433	.000
	SSP	.695	.056	.557	12.497	.000

The result in Table 4 shows the t-test analysis associated with linear regression of the predictive power of self-perception on secondary school students’ academic achievement in chemistry. The result shows that a t-value (t=12.497, p-value= 0.00) was obtained in the predictive power of self-perception on secondary school student's academic achievement in chemistry. This associated probability of 0.00 is less than the 0.05 level of significance at which the hypothesis was tested. Hence, the null

hypothesis, which stated that there is no significant predictive power of self-perception on secondary school students’ academic achievement in chemistry, is rejected. The inference drawn is that the predictive power of self-perception on secondary school students’ academic achievement in chemistry is statistically significant. This implies that students’ self-perception can be used to forecast their academic achievement in chemistry.

Table 5: Linear regression analysis of the joint predictive power of self-regulation and self-perception on secondary school students’ academic achievement in chemistry

Model	N	R	R ²	Adjusted R ²
1	349	0.676	0.456	0.454

R=Correlation coefficient, R²=Coefficient of determination

The result in Table 5 shows the joint predictive power of self-regulation and self-perception on secondary school students’ academic achievement in chemistry. The correlation coefficient (R) 0.676 shows that there is a strong positive relationship among self-regulation and self-perception

and secondary school students’ academic achievement in chemistry. Furthermore, the coefficient of determination (R²) 0.456 shows that, 45.6% variation in secondary school students’ academic achievement in chemistry is attributed to the combination of self-regulation and self-perception.

Table 6: ANOVA F-test of no significant joint predictive power of self-regulation, and self-perception on secondary school student's academic achievement in chemistry.

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	1396.556	2	698.278	142.215	.000 ^a
	Residual	1699.142	346	4.910		
	Total	3095.698	348			

In order to test hypothesis 4 (H_{04}), the F-test was used to test for the significance of regression. The result in Table 6 shows that an F-ratio of (142.215) with an associated exact probability value of (0.00) was obtained. This probability value of (0.00) was compared with (0.05) set as the level of significance for testing the hypothesis, and it was found to be significant because (0.00) is less than (0.05). The null hypothesis, which stated that there is no significant joint predictive power of self-regulation and self-perception on secondary school students' academic achievement in chemistry, was therefore rejected. The inference drawn is that the joint predictive power of self-regulation and self-perception on secondary school students' academic achievement in chemistry is statistically significant. This implies that the combination of self-regulation and self-perception can be used to forecast academic achievement in chemistry.

Discussion

The result shows that self-regulation accounts for 40.8% variation in secondary school students' academic achievement in chemistry. This implies that the predictive power of self-regulation on secondary school student's academic achievement in chemistry is significant. This finding is in line with the report of Appiah-Kubi, Amponsah and Asoma (2022), who reported that self-regulation, had significant impact on students' academic achievement. This finding also agree with the finding of Ezugwu and Mazi-Iguwe (2018), who revealed among other things that there is a significant positive relationship between students' self-regulation and their academic achievement. Hence, self-regulation can be used to forecast students' academic achievement.

The result shows that self-perception accounts for 31% variation in secondary school students' academic achievement in chemistry. This implies that the predictive power of self-perception on secondary school student's academic achievement in chemistry is significant. This finding aligns with the finding of Okafor, Obialor and Osuafor, (2020), who revealed

that there is a significantly positive relationship between students' self-perception and their academic achievement. The finding is also in line with that of Ajunwo (2018), which showed that students' self-perception significantly relates to their academic achievement. Hence, the finding of the study adds to empirical reports that self-perception is a significant predictor of senior secondary school students' academic achievement in chemistry.

The result shows that self-regulation and self-perception jointly accounts for 45.6% variation in secondary school students' academic achievement in chemistry. This implies that the joint predictive power of self-regulation and self-perception on secondary school students' academic achievement in chemistry is statistically significant. Therefore, self-regulation and self-perception singly or taken together, can be used to forecast or predict secondary school students' academic achievement in chemistry. This finding is in line with the report of Appiah-Kubi, Amponsah and Asoma (2022), who reported that self-regulation had significant impact on academic achievement. The finding aligns with that of Okafor, Obialor and Osuafor, (2020), who revealed that there is a significant positive relationship between students' self-perception and their academic achievement. This shows that an increase in students' self-regulation and students' self-perception will lead to an increase in academic achievement in chemistry. This shows that students' self-regulation and students' self-perception taken together is a determining factor in students' academic achievement in chemistry as revealed in this present study.

Conclusions

The findings of this study revealed that self-regulation and self-perception predict the students' academic achievement; they are good predictors of secondary school students' academic achievement in chemistry. The corresponding hypotheses respectively revealed that self-regulation and self-perception taken together or singly significantly predicts students' academic achievement in chemistry.

Recommendations

1. Government and secondary school administrators should prioritize the integration of self-regulation and self-perception in the classroom instructions. This can be achieved by emphasizing and providing a continuous instructional behavior on self-regulation and self-perception practices by the teachers.
2. Encourage goal-driven learning in chemistry. This can be obtained by providing the students with study tasks that requires the students to put in a substantial effort of self-regulation and self-perception to be accomplished by the teacher.
3. Chemistry students should learn to draw a personal fitting to self-regulation and self-perception such as setting of goals, organizing study tasks, managing time, understanding their strengths, weaknesses and ability to persist in completing their study tasks despite challenges. With this approach, learning chemistry will be welcomed and duly followed and this will in turn increase students' potential for academic success in chemistry.

References

- Abbas, J., Aman, J., Nurunnabi, M., & Bano, S. (2019). The impact of social media on learning behavior for sustainable education: Evidence of students from selected universities in Pakistan. *Sustainability*, 11(6), 1683-1694.
- Ajunwo, E. (2018). Self-perception and academic achievement scores of undergraduate business education students in Rivers State. *International Journal of Innovative Psychology & Social Development*, 6(3), 6-17.
- Aladejana, A. L., & Fatoba, J. O. (2022). Effects of drill and practice instructional strategy on senior secondary school students' mathematical skills in physics in Ekiti State, Nigeria. *International Journal of Education, Psychology and Counseling*, 7(45), 190-198.
- Appiah-Kubi, E., Amponsah, M. O., Nti-Adarkwah, S., & Asoma, C., (2022). Assessing the influence of gender on self-regulated learning and academic engagement among senior high school students in Ghana. *European Journal of Educational and Development Psychology*, 10(2), 28-41.
- Drüsedau, L. L., Götz, A., Kleine Büning, L., Conzelmann, A., Renner, T. J., & Barth, G. M. (2023). Tübinger training for autism spectrum disorders (TüTASS): A structured group intervention on self-perception and social skills of children with autism spectrum disorder (ASD). *European Archives of Psychiatry and Clinical Neuroscience*, 273(7), 1599-1613.
- Ezugwu, E. & Mazi-Iguwe, J. (2018). *Learning strategy and self-regulation as correlates of academic achievement of students in chemistry in senior secondary school in Nsukka local government area in Enugu State*. (Unpublished master's thesis), University of Nigeria.
- Firman, F., Mirnawati, M., Sukirman, S., & Aswar, N. (2020). The relationship between student learning types and Indonesian language learning achievement in Ftikiain Palopo students. *Jurnal Konsepsi*, 9(1), 1-12.
- Hadinugrahaningsih, T., Rahmawati, Y., & Ridwan, A. (2017). Developing 21st century skills in chemistry classrooms: Opportunities and challenges of STEAM integration. In *AIP Conference Proceedings*, (vol. 1868, no. 1). AIP Publishing.
- Hardy, J. G., Sdepanian, S., Stowell, A. F., Aljohani, A. D., Allen, M. J., Anwar, A., ... & Wright, K. L. (2021). Potential for chemistry in multidisciplinary, interdisciplinary, and transdisciplinary teaching activities in higher education. *Journal of Chemical Education*, 98(4), 1124-1145.
- Hassan, A. A., Ali, H. I., Salum, A. A., Kassim, A. M., Elmoge, Y. N., & Amour, A. A. (2017). Factors affecting students' performance in chemistry: Case study in Zanzibar secondary schools. *International Journal of Educational and Pedagogical Sciences*, 9(11), 4086-4093.
- Kanapathy, S., Lee, K. E., Mokhtar, M., Syed Zakaria, S. Z., Sivapalan, S., & Mohd Zahidi, A. (2019). Sustainable chemistry teaching at the pre-university level: Barriers and opportunities for university educators. *International Journal of Sustainability in Higher Education*, 20(4), 784-802.
- Maehr, M. L. (2017). On doing well in science: Why Johnny no longer excels; why Sarah never did. In: Paris, S. G., Olson, G. M., & Stevenson, H. W. (Eds.) *Learning and motivation in the*



- classroom* (pp. 179-210). London: Routledge.
- Marsh, H. W., Martin, A. J., Yeung, A. S., & Craven, R. G. (2017). Competence self-perceptions. In: Elliot, A. J., Dweck, C. S., & Yeager, D. S. (Eds.). *Handbook of competence and motivation: Theory and application*. (pp. 85-115). Guilford Publications.
- McClelland, M., Geldhof, J., Morrison, F., Gestsdóttir, S., Cameron, C., Bowers, E., ... & Grammer, J. (2018). Self-regulation. In: Halfon, N., Forrest, C. B., Lerner, R. M., & Faustman, E. M. (Eds.) *Handbook of life course health development*. Retrieved from library.oapen.org.
- Okafor, E. O., Obialor, C. O., & Osuafor, A. M. (2020). Secondary school students' self-concept and gender as correlates of academic achievement in biology in Imo State. *Journal of CUDIMAC*, 8(1), 151-162.
- Olufemi, O. T., Adediran, A. A., & Oyediran, W. O. (2018). Factors affecting students' academic performance in colleges of education in Southwest, Nigeria. *British Journal of Education*, 6(10), 43-56.
- Ortega-Torres, E., Solaz-Portoles, J. J., & Sanjosé-López, V. (2020). Inter-relations among motivation, self-perceived use of strategies and academic achievement in science: A study with Spanish secondary school students. *Sustainability*, 12(17), 6752-6759.
- Sithole, A., Chiyaka, E. T., McCarthy, P., Mupinga, D. M., Bucklein, B. K., & Kibirige, J. (2017). Student attraction, persistence and retention in STEM programs: Successes and continuing challenges. *Higher Education Studies*, 7(1), 46-59.
- Zimmerman, B. J. (2013). Theories of self-regulated learning and academic achievement: An overview and analysis. *Self-regulated Learning and Academic Achievement*, 1-36.