



## Examining the Predictive Power of Students' Self-Esteem and Self-Efficacy on Academic Achievement in Chemistry

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### Abstract

This study was conducted to examine the predictive power of students' self-esteem and self efficacy on their academic achievement in chemistry. The study was guided by three research questions and three hypotheses. This study was carried out in Enugu State. The study adopted predictive correlation research design. The population of the study comprised of 18,276 public senior secondary school 2 Chemistry students for 2025/2026 academic session, with sample of 391 Chemistry students from Enugu State. This sample was drawn using multi-stage sampling technique. Three instruments were drawn for data collection; Students' Chemistry Self-Esteem Scale (SCSES), Chemistry Students' Self-Efficacy Scale (CSSES) and Chemistry Achievement Test (CAT). SCSES and CSSES internal consistency reliability indices were established to be 0.84 and 0.79 with the use of Cronbach alpha while a CAT internal consistency reliability index was 0.86; which was established using KR-20. Simple linear regression was used to answer research question 1 and 2 while multiple regression was used to answer research question three but regression t-test was used to test hypotheses 1 and 2 while hypotheses 3 was tested using regression ANOVA at 0.05 level of significance. The result shows that students' self-esteem and self-efficacy separately and jointly positively significantly predict academic achievement in chemistry. From the findings, it was recommended among others that, Teachers should integrate self-esteem and self-efficacy into their instructional approaches delivered in the classroom to enhance students' academic and achievement in chemistry.

**Keywords:** Chemistry, Achievement, self-esteem, self-efficacy.

### Introduction

Chemistry is an essential science subject that helps us meet our basic needs such as food, shelter, clothing, health, energy, clean air, water and soil. Chemistry is also a subject of global impact and, as a fundamental science; it has a profound effect on our planet and on everyday life. Almost every new technological change and important discovery has its foundation in chemistry. Chemistry, a physical science subject that deals with the study of composition, structure and properties of matter and the changes they undergo at different conditions (Nwaka, Egbo & Okechineke 2016). Also, Rushton, Dewar, Ray, Criswell and Shah (2016) rated chemistry as a "central science" because it serves as the interface to practically all other sciences as well as to many other areas of

human endeavours. Chemistry is a branch of science that explores the composition, properties, and applications of matter (Ababio, 2017). This means that chemistry inquires into the nature of matter. Therefore, chemistry is the study of matter, and matter is anything that has mass and occupies space. Thus, chemistry is the study of everything around us because everything we use in our different homes is a product of chemistry and technology.

The role of chemistry cannot be over emphasized in our present society. Chemistry has helped a lot in the following areas: health, agriculture, food security, information and communication, housing, road construction, comfort, convenience and pleasure, life process, transportation, clothing, etc. All



the professional courses in science require sound and quality knowledge of chemistry. Considering these benefits of chemistry, it is important and pertinent that students intending to pursue career in chemistry or chemistry related courses are expected to obtain a minimum of credit pass in chemistry in West African Senior School Certificate Examination (WASSCE) conducted by West African Examination Council (WAEC), National Examination Council (NECO) and National Business and Technical Examination Board (NABTEB) before being admitted to study these courses. Hence, the teaching and learning of chemistry should be accorded high priority to ensure students' high success rate. This will help to lay a solid and effective foundation for higher studies in chemistry and other science-based courses in a tertiary institution. In view of the benefits of chemistry, the government and other stakeholders in education have made efforts to ensure high teaching and learning quality. Researchers (Ahamd, Zeb, Ullah, & Ali, 2019; Ezinwa, 2021) have also recommended innovative teaching methods and strategies that will enhance students' learning. All these efforts are geared toward ensuring Chemistry students obtained high academic achievement.

Achievement is the amount of success obtained at the end of a given specific or general task or work. It can also be seen as a thing done successfully, typically by effort, courage, or skill. Achievement is also seen as the degree of success obtained when a specific or particular task is completed successfully. Okonkwo (2016) asserted that academic achievement is a scholastic position of a student at any given time. Students' achievement is a measure of the amount of academic content a student learns in a determined amount of time (Okere, Ugwuanyi, & Ezeokoye, 2025). Students' academic achievement is a term used to indicate or notable degree or level or measure of students' successful completion of a particular task and examination. Academic achievement is the extent to which a student has attained educational goals. Considering the importance of Chemistry at the secondary school level, it is expected that the academic achievement of the students in external examinations ought to have improved. Regrettably, evidence from WASSCE has shown that students still have poor academic achievement in chemistry. Data from WAEC Chief Examiner's reports showed that the overall academic achievement of students in chemistry has been poor over the years. For instance, available evidence from analysis of May/June WASSCE in chemistry in Nigeria for 2018, 2019, 2020, 2021, 2022

and 2023 showed students' raw mean scores of 47.0, 29.0, 54.0, 49.0, 45.0 and 34.0, respectively. There are some factors that have been identified by the researchers, which may be the reason behind the poor academic achievement in chemistry. These factors according to the researchers include: class size and gender (Jack, 2018), physical, social or psychological factors, curriculum inadequacy problem of funding (Afriliani & Holangyah, 2018), combination of factors which could be physical, social or psychological (Nawfor, 2021), poor study habits (Agbo, 2023), and Iwuagwu (2024) found that there is poor academic achievement of students in Chemistry due to the combination of some factors, which could be physical, social or psychological such as self-efficacy and self-esteem.

Self-esteem is the value an individual places on themselves relative to others. According to Okafor (2021), self-esteem is defined as the total feeling of value, worth, and assurance that an individual has about themselves. Self-esteem is a critical component of psychological well-being and influences how people perceive themselves, their relationships, and their ability to handle challenges (Cooper & Stowe, 2018). According to researchers like Sharma and Sharma (2025), who conducted a study on self-esteem and academic achievement, found a positive and significant relationship between self-esteem and academic achievement. Again, Körük (2017) discovered in his work that self-esteem has a positive effect on students' academic achievement. Another factor that affects students' academic achievement is students' self-efficacy. According to Gang, Han and Bansa, (2019), self-efficacy is our overall evaluation and perception of our worth as human being which is based on our positive or negative perception that makes up ourselves. Hornstein and Ross (2018) described self-efficacy as positive or negative attitude towards oneself. In the context of this study, self-efficacy is the ability of one to value, cherish, accept, trust and appreciate oneself. School setting, self-efficacy is very important because its development is an underlying factor in promoting students' motivation, persistence and academic success. According to researchers like Hayat and Shateri, (2020) who worked on academic achievement and self-efficacy stated that students' academic achievement has a significant relationship with students' self-efficacy. Also, Zheng, Chang, Lin, and Zhang (2021) discovered that self-efficacy predicts the students' academic achievement. On the Contrary, Bwenvu's (2019) revealed that there is a moderate correlation but no

significant relationship between self-efficacy and academic achievement. Considering the disparities on the findings on self-efficacy, the poor students academic achievement in Chemistry and the importance of chemistry as well as students' self-esteem, the researchers deemed it necessary to investigate more on students' self-esteem and self-efficacy as predictors of students' academic achievement in Chemistry.

### **Purpose of the study**

1. Predictive power of students' self-esteem on their academic achievement in chemistry.
2. Predictive power of students' self-efficacy on their academic engagement in chemistry.
3. Joint predictive power of students' self-esteem and self-efficacy on their academic achievement in Chemistry.

### **Research questions**

1. What is the predictive power of students' self-esteem on their academic achievement in chemistry?
2. What is the predictive power of students' self-efficacy on their academic achievement in chemistry?
3. What is the joint predictive power of students' self-esteem and self-efficacy on their academic achievement in chemistry?

### **Hypotheses**

1.  $H_{01}$ : There is no significant predictive power of students' self-esteem on their academic achievement in chemistry
2.  $H_{02}$ : There is no significant predictive power of students' self-efficacy on their academic achievement in chemistry.
3.  $H_{03}$ : There is no significant predictive power of students' self-esteem on their academic achievement in chemistry.

### **Methods**

This study adopted a predictive correlation research design. This type of correlation research design aims to provide insight into potential future scenarios by analyzing patterns and relationships in current data. The predictive correlation research design

aims at determining if there is any predictive power between self-esteem and self-efficacy on students' academic achievement in Chemistry. The study was carried out in Enugu State. The population of the study comprised of 18,276 senior secondary school (SS2) Chemistry students in all the 293 public senior secondary schools in Enugu state (Source: Post Primary School Management Board, PPSMB, Enugu State, 2025/2026 Academic Session). The sample size of 391 senior secondary school (SS2) chemistry students was adopted using Multistage sampling procedure. Three instruments were used for data collection in this study. The instruments are the Students' Chemistry Self-Esteem Scale (SCSES), Chemistry Students' Self-Efficacy Scale (CSSES) and Chemistry Achievement Test (CAT). The instruments were adopted apart from CAT while the scoring pattern after modification were; Very Often (VO) = 4, Often (O) = 3, Not Often (NO) = 2 and Never (N) = 1. The Chemistry Achievement Test (CAT), a 30-item instrument, was developed by the researcher. The instruments CSSES and SCSES were subjected to face validation. To determine the face validity, the instruments were given to three validators: two from Chemistry Education and one from Measurement and Evaluation units of the Department of Science Education, University of Nigeria, Nsukka. To determine the content validity of CAT, the development was guided by a table of specifications. The items which comprised of 60 questions on the instrument were written to cover both the lower and higher order questions with respect to the SS II level of students. This was done using the modified Bloom's taxonomy. To obtain the reliability of the instruments, the instruments were trial tested on thirty (30) SS2 Chemistry students from a school that was not sampled for the study in Enugu State for the pilot study. For the CSSES and SCSEC the reliability index of 0.84 and 0.79 were obtained respectively using Cronbach Alpha formula while that of CAT reliability index of 0.86 was obtained using Kuder-Richardson Formula Twenty ( $K-R_{20}$ ) formula. The study adopted face to face method of data analysis. Simple linear regression was used to answer research question one and two while research question three was answered using multiple regression. Regression T-test was used to test hypotheses one and two while hypothesis three was tested using regression ANOVA.

## Result

### Research Question One

**Table 1: Linear regression analysis for the predictive power of students' self-esteem on their academic achievement in chemistry**

| Model                                | N   | r                 | R <sup>2</sup> |
|--------------------------------------|-----|-------------------|----------------|
| Self-Esteem and Academic Achievement | 391 | .199 <sup>a</sup> | .040           |

The result in Table 1 shows the linear regression analysis of the predictive power of senior secondary school students' self-esteem on academic achievement in chemistry. The result shows a correlation coefficient (r) of .199. This implies a low positive predictive power of self-esteem on students' academic achievement in chemistry. The coefficient of determination (R<sup>2</sup>) associated with the correlation

coefficient of .199 was .040. This implies that 4% variation in students' academic achievement in chemistry is attributed to the predictive power of students' self-esteem. The result indicates that 96 % of the variation in students' academic achievement in chemistry is attributed to other factors other than the predictive power of students' self-esteem.

### Hypothesis One

**Table 2: Regression t-test analysis result of students' self-esteem predicting their academic achievement in chemistry**

| Model        | Unstandardized Coefficients |            | Standardized Coefficients | T     | Sig. |
|--------------|-----------------------------|------------|---------------------------|-------|------|
|              | B                           | Std. Error | Beta                      |       |      |
| 1 (Constant) | 18.524                      | 8.288      |                           | 2.235 | .026 |
| Self-esteem  | .552                        | .138       | .199                      | 4.003 | .000 |

The result in Table 2 indicated that a t-value of 4.003 with an associated exact probability value of .000 was obtained. This probability value of 0.000 was compared with 0.05, considered as the level of significance in testing the null hypothesis, and the result was found to be significant since the obtained probability value of 0.000 is less than 0.05. Therefore,

the null hypothesis, which asserted that there is no significant predictive power of senior secondary school students' self-esteem on academic achievement in Chemistry, was rejected. The researchers, therefore, concludes that self-esteem is a positive predictor of students' academic achievement in chemistry.

### Research Question Two

**Table 3: Output of regression analysis for the predictive power of students' self-efficacy on their academic achievement in chemistry**

| Model                                  | N   | r                 | R <sup>2</sup> |
|----------------------------------------|-----|-------------------|----------------|
| Self-Efficacy and Academic Achievement | 391 | .201 <sup>a</sup> | .041           |

The result in Table 3 shows the linear regression analysis of the predictive power of senior secondary school students' self-efficacy on academic achievement in chemistry. The result revealed a correlation coefficient (r) of .201. This implies a low predictive power of self-efficacy on students' academic

achievement in chemistry. The coefficient of determination (R<sup>2</sup>) associated with the correlation coefficient of .201 was .041. This implies that 4.1% variation in students' academic achievement in chemistry is attributed to the predictive power of students' self-efficacy. The result indicates that 95.9%

of the variation in students' academic achievement in chemistry is attributed to other factors order than the predictive power of students' self-efficacy.

### Hypothesis Two

**Table 4: Regression t-test analysis result of students' self-efficacy predicting their academic achievement in chemistry.**

| Model |               | Unstandardized Coefficients |            | Standardized Coefficients | t     | Sig. |
|-------|---------------|-----------------------------|------------|---------------------------|-------|------|
|       |               | B                           | Std. Error | Beta                      |       |      |
| 1     | (Constant)    | 19.062                      | 8.047      |                           | 2.369 | .018 |
|       | Self-efficacy | .514                        | .127       | .201                      | 4.057 | .000 |

The result in Table 4 shows that a t-value of 4.057 with an associated exact probability value of .000 was obtained. This probability value of 0.000 was compared with 0.05, put as the level of significance for testing the null hypothesis, and the result was found to be significant since the obtained probability value of 0.000 is less than 0.05. Therefore, the null hypothesis,

which stated that there is no significant predictive power of students' self-efficacy on their academic achievement in Chemistry, was rejected. The researchers, however, conclude that self-efficacy is a positive predictor of students' academic achievement in chemistry.

### Research Question Three

**Table 5: Multiple regression analysis for the predictive power of students' self-esteem and self-efficacy on academic achievement in chemistry**

| Model                                               | N   | r                 | R <sup>2</sup> |
|-----------------------------------------------------|-----|-------------------|----------------|
| Self-Esteem, Self-Efficacy and Academic Achievement | 391 | .244 <sup>a</sup> | .060           |

The result in Table 5 shows the multiple regression analysis of the predictive power of senior secondary school students' self-esteem and self-efficacy on academic achievement in chemistry. The result shows a correlation coefficient (r) of .244. This implies a low positive power of students' self-esteem and self-efficacy on their academic achievement in chemistry. The coefficient of determination (R<sup>2</sup>)

associated with the correlation coefficient of .244 was .060. This implies that 6% variation in students' academic achievement in chemistry is attributed to the predictive power of students' self-esteem and self-efficacy the result indicates that 94% of the variation in students' academic achievement in chemistry is attributed to other factors other than the joint predictive power of students' self-esteem and self-efficacy.

### Hypothesis Three

**Table 6: Regression ANOVA result of students' self-esteem and self-efficacy predicting their academic achievement in chemistry.**

| Model |            | Sum of Squares | Df  | Mean Square | F     | Sig.              |
|-------|------------|----------------|-----|-------------|-------|-------------------|
| 1     | Regression | 8338.427       | 2   | 2779.476    | 8.169 | .000 <sup>b</sup> |
|       | Residual   | 131675.179     | 388 | 340.246     |       |                   |
|       | Total      | 140013.606     | 390 |             |       |                   |

Result in Table 6 shows  $F(1,390) = 8.169$ ,  $p = 0.000$ ) for predictive power of self-esteem, self-efficacy on academic achievement. Since the probability value of 0.00 is less than the alpha level of 0.05, the null hypothesis is rejected. Therefore, the researchers conclude that self-esteem, self-efficacy jointly predicts significantly students' academic achievement in chemistry.

### Discussion of findings

This study revealed that self-esteem significantly predicts students' academic achievement in chemistry. The result of the study agrees with the findings of Sharma and Sharma (2020), who found a positive and significant relationship between self-esteem and academic achievement. The result also aligns with the findings of Karouk (2017), who discovered that self-esteem has a positive effect on students' academic achievement. The findings of this study also show that self-efficacy significantly predicts students' academic achievement in chemistry. Hence, the findings of this study is in line with the findings of Hayat, Shateri, Amini and Shokrpour (2020), that students' academic achievement has a significant relationship with students' self-efficacy. Also, the findings align with those of Zheng, Chang, Lin, and Zhang (2021) who discovered that self-efficacy predicts the students' academic achievement. Contrary to the findings of this study, Bwenvu's (2019) findings revealed a moderate correlation but no significant relationship between self-efficacy and academic achievement. The possible explanation for the discrepancy in the results could be the variations in the level of education and academic disciplines that were employed in the research. It is then possible for a student to have strong self-efficacy in one area and level and poor self-efficacy in another area and level. To be sure of greater academic achievement, it is important that schools foster a high level of self-esteem and self-efficacy.

### Conclusion of the study

Based on evidence from the findings and discussions of the study, the researchers concluded that self-esteem and self-efficacy have low predictive power and significantly predict students' academic achievement in Chemistry in Enugu State, Nigeria, both as individual factors and joint predictors. Hence, one can conclude that if students have low self-esteem and low self-efficacy, those students academic achievement will be low but if students have high self-esteem and self-efficacy those students academic achievement will increase.

### Recommendations

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

1. Curriculum planners should understand the role of self-efficacy and self-esteem and how they relate to academic achievement in chemistry, especially when there is a low positive prediction among the variables.
2. The government should provide a platform such as organizing workshops, conferences and seminars, to train chemistry teachers on how to improve and sustain students' self-esteem and self-efficacy.
3. Parents should reduce criticism of their children, but see the need to encourage them to achieve better academic achievement in their studies.
4. School authorities should ensure that Students are exposed to conditions that support their collaboration with each other. This will help them to increase their self-esteem and self-efficacy which in turn will increase their academic achievement in chemistry.
5. Teachers should integrate self-esteem and self-efficacy into their instructional approaches



delivered in the classroom to enhance students' academic achievement in chemistry.

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